THE JOURNAL OF GAS LIGHTING
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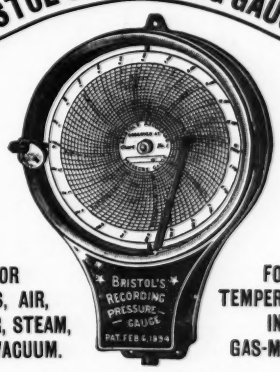

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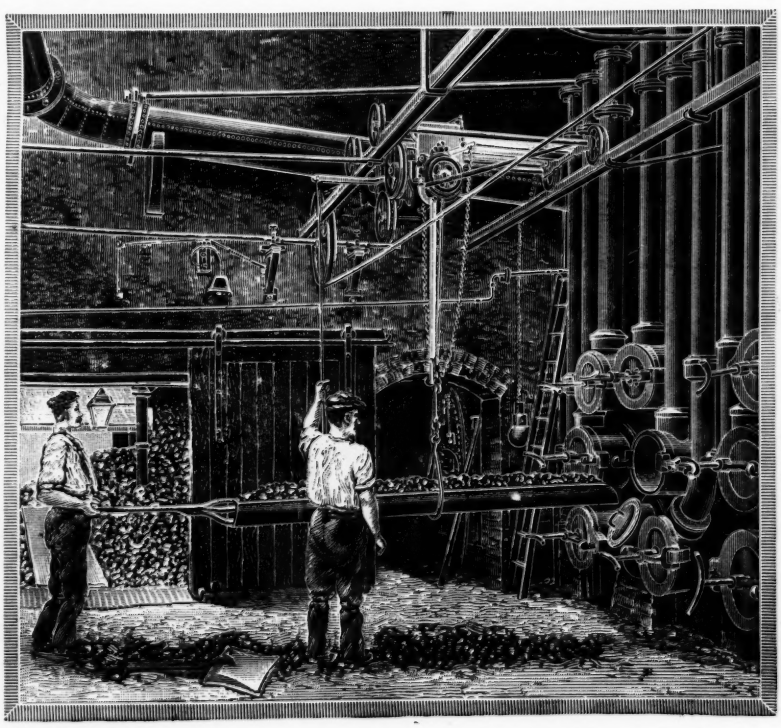

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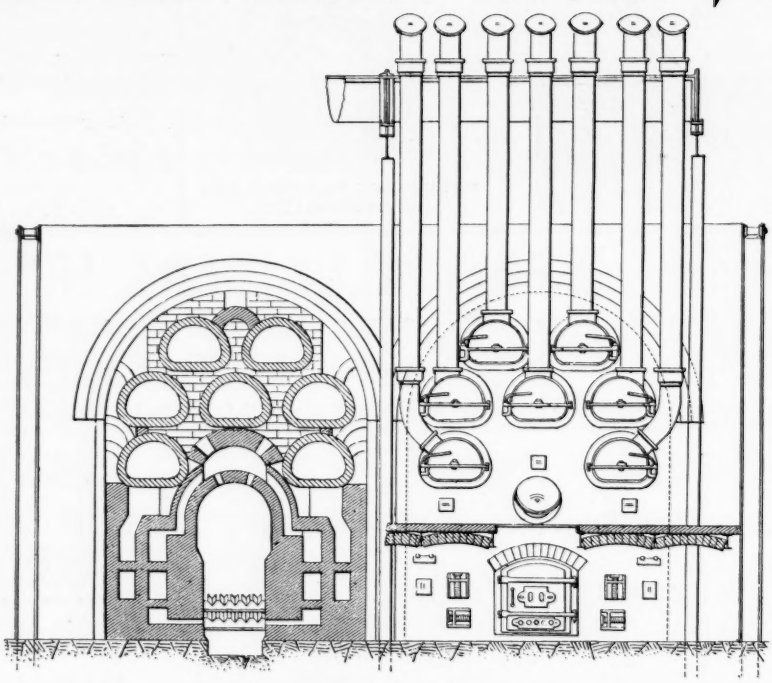

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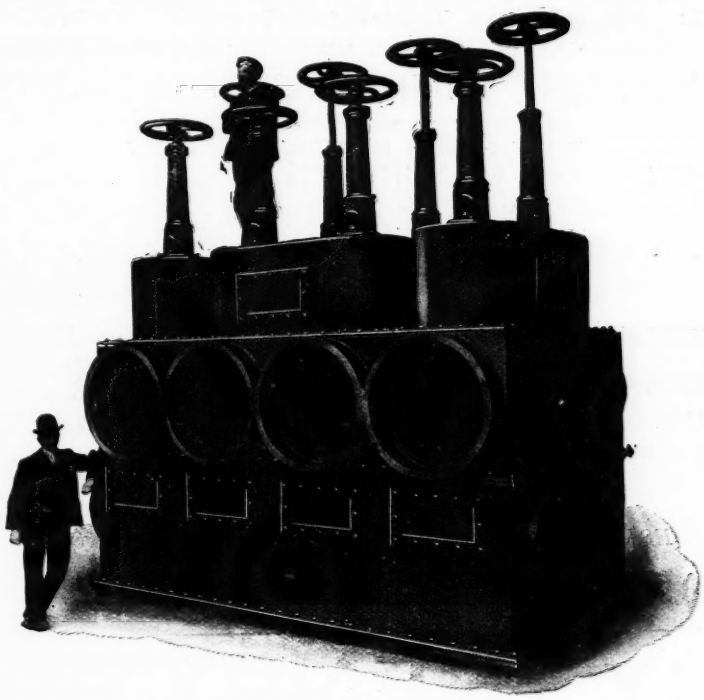

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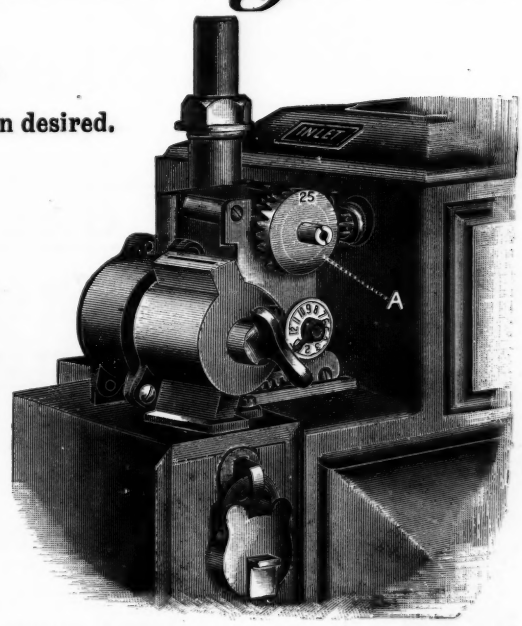

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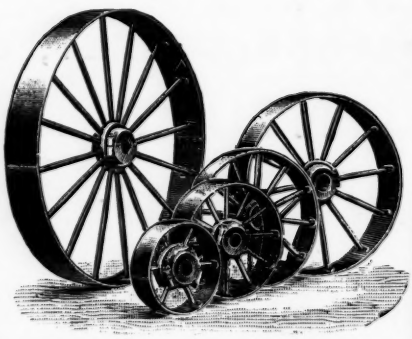

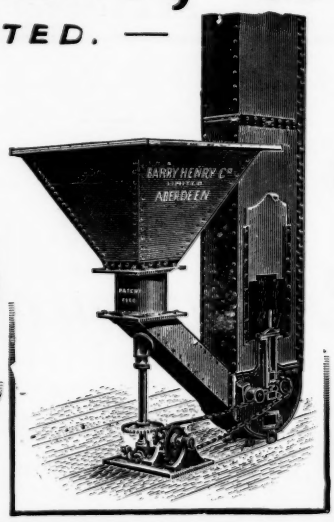

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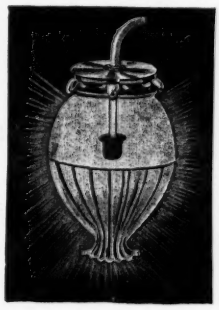

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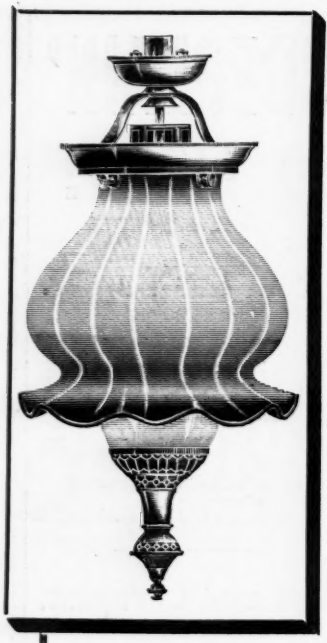

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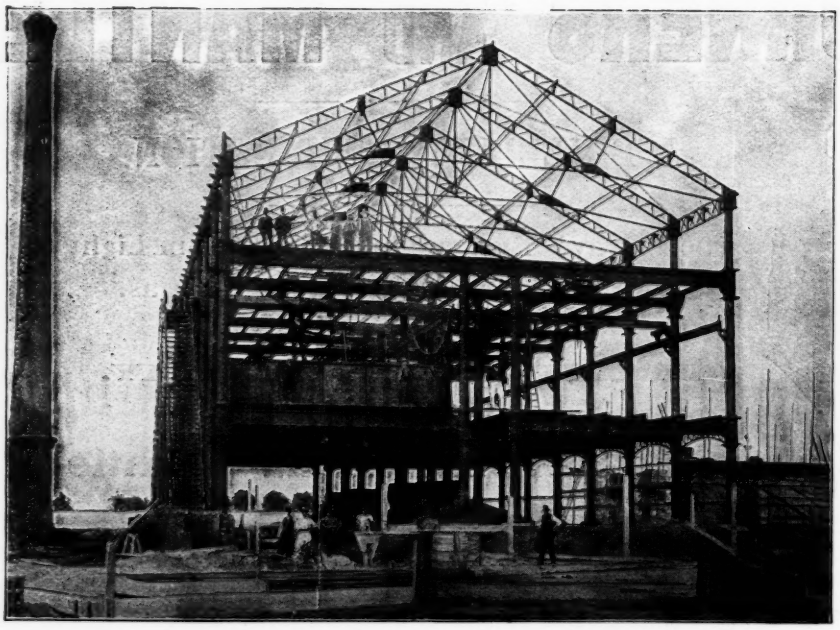

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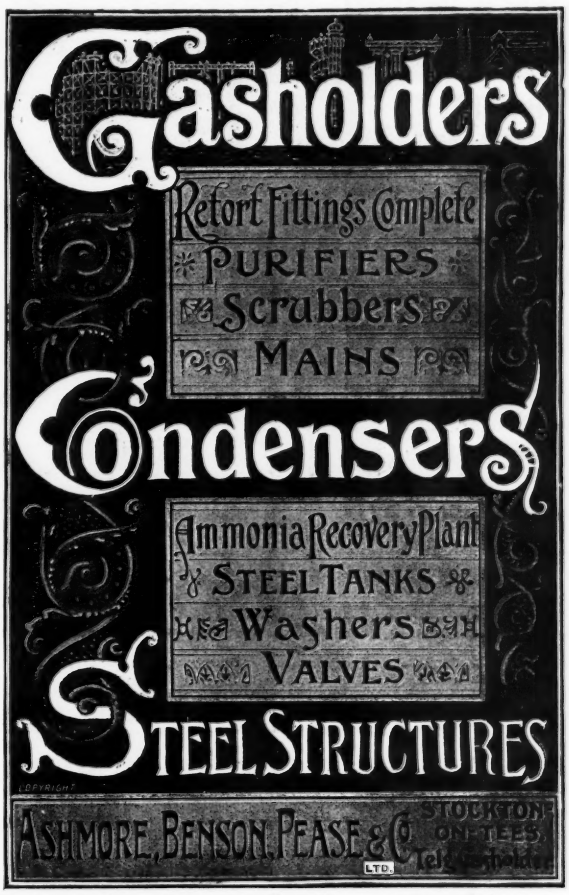

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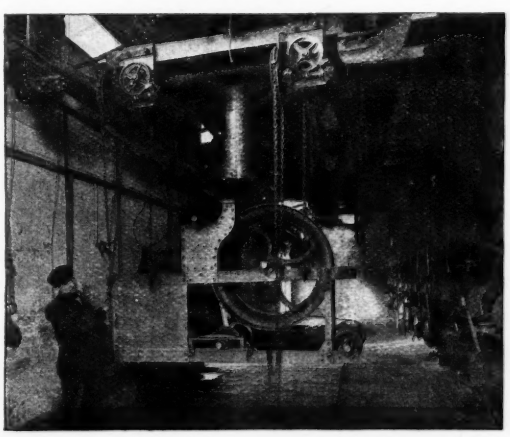

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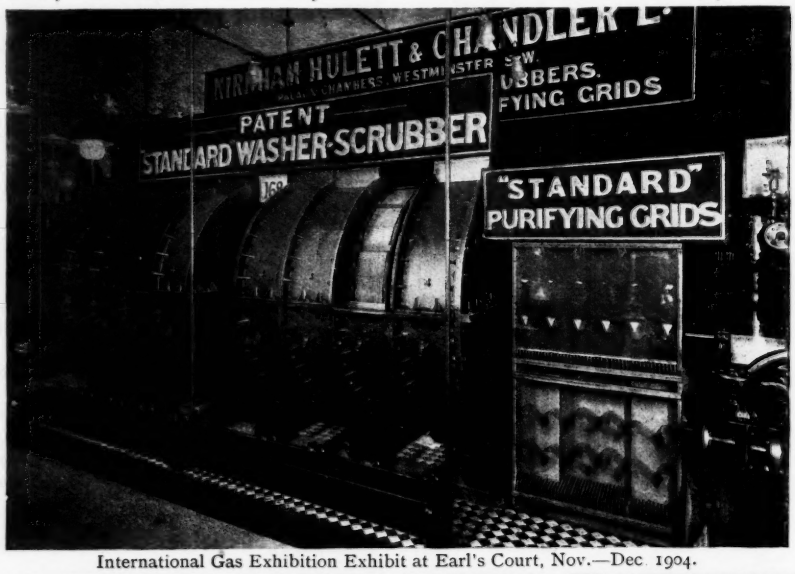

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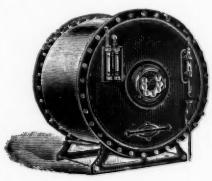

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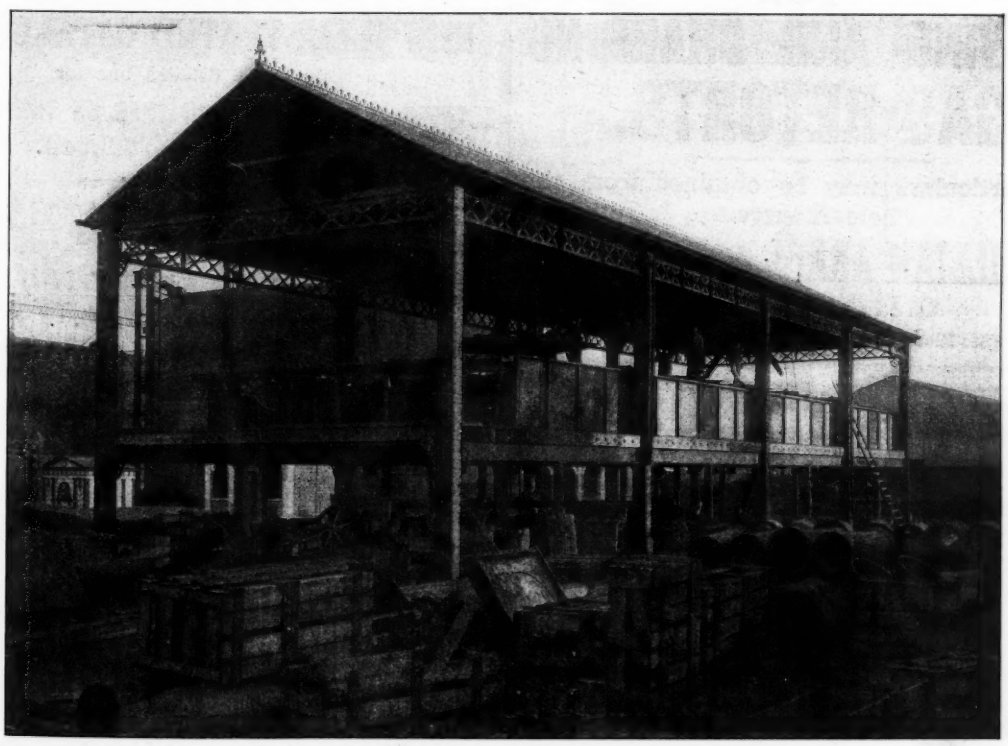

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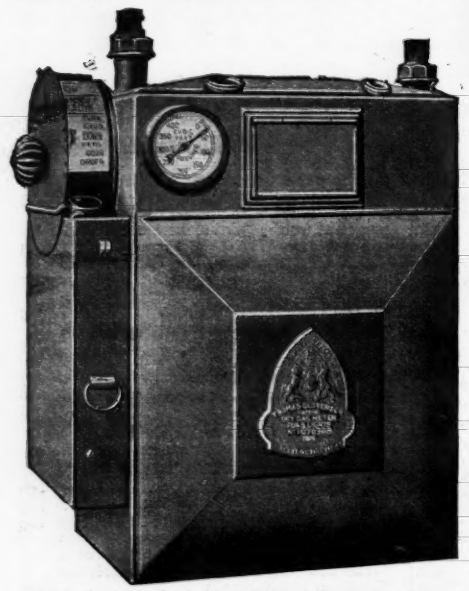

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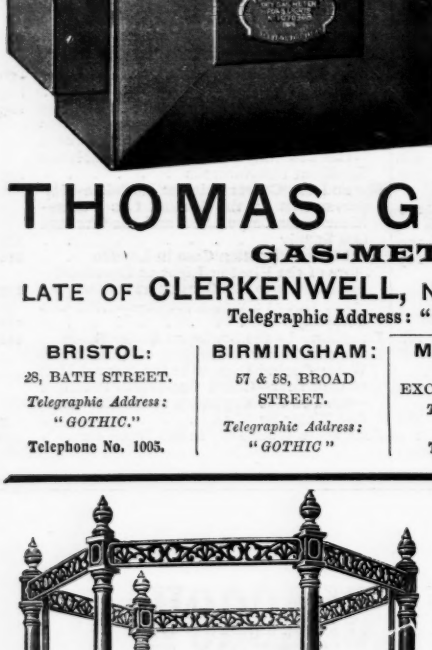

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EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. LXXXIX., No. 2174.—TUESDAY, JANUARY 10, 1905.

EDITORIAL NOTES—GAS, &c.

Gas Bills for 1905.

THIS week we complete our summary of these, and a perusal of it will be found to fully justify the opinion which was formed from a survey of the notices that the coming session of Parliament promises, as regards gas matters (apart from those relating to the Metropolis), to be one of the dullest on record. There is but little that affords the prospect of a contest on a matter of principle, or that indicates any new departure; on the contrary, the framers of the Bills appear to have proceeded almost entirely on the lines of least resistance. If there be any exceptions to this, they are not such as appear likely to occupy any great length of time for their consideration before Committees. The number of companies who are for the first time making application for parliamentary powers and incorporation is the same as last year; but with the exception of the three London Companies and the South Suburban Company, whose Bills, together with that of the London County Council, were considered last week, there are only five Companies already possessing parliamentary powers who are seeking for these to be extended. Of these, the Bill promoted by the Croydon Gas Company may be described as being one for the furtherance of that policy of absorption of neighbouring undertakings which was inaugurated some years ago by their amalgamation with the Carshalton Gas Company. It may be presumed that this union has proved a success, since the Company are now seeking for powers to similarly acquire the undertaking of the Caterham and District Gas Company, and, consequently, to extend their area of supply so as to embrace that of the latter Company. There is considerable disparity between the prices charged for gas by the two undertakings; and this is to be continued for a time, as justice to the Croydon consumer requires that it should be. It is provided that in the Caterham Company's district the price of gas shall, for seven years, be not less than 4d. nor more than 8d., and, after seven years, not more than 4d. per 1000 cubic feet in excess of the price charged for the time being in the district of the original Croydon Company. The consumers in the Caterham district are thus assured of a substantial advantage at the end of seven years, which they could not hope to obtain under existing conditions, seeing that the Caterham Company are somewhat heavily capitalized; while the Croydon consumers will ultimately reap the benefit of economies resulting from amalgamation, and the operations of the Company being extended over a large and increasing district.

In addition to the four Companies who are applying for further powers in regard to gas supply, the Shepton Mallet Gas Company are promoting a Bill the sole object of which is to empower them to supply electricity within their gas area—the generating station to be erected on part of the gas-works site; but the plant and works for supplying electrical energy are to be kept separate from the gas-works. The gas and electricity capitals are also to be distinguished, and separate revenue accounts kept. Three of the companies who are now seeking to be incorporated desire to be empowered to apply, if they think fit, for Provisional Orders to supply electrical energy, as provided for in the Model Gas Bill; and another of these—the Andover Gas and Coke Company—have included in their Bill, the title of which is the Andover Lighting and Power Bill, full powers for supplying electricity within the borough of Andover. Very few of the companies include provisions relating to prepayment meters and fittings, and those who have are not in accord with regard to them. This may turn out to be unfortunate, since, however much such regulation is to be deprecated, the question is certain to arise before the Chairman of Committees of either House; and it would be as well for all applicants for additional powers in regard to finance to make up their minds as to what are likely to be the most suitable terms. Our opinion, as expressed in these columns on the 25th of October last, is that, if a regulation has to be submitted to, one that differentiates between the use of a meter alone, or a meter and fittings, or meter, fittings, and cooker, is preferable from all points of view to a maximum charge without regard to circumstances. On the question of discount, also, the Bills show very considerable diversity. Last year the tendency of Parliament was to sanction discounts up to the giving of 10 per cent. for prompt payment, with a further margin of 15 per cent. for large consumers; and these appear to be terms that might with advantage be made generally applicable—always assuming that Parliament in its wisdom does not see fit to grant to gas undertakings full commercial freedom in this respect.

A very noticeable feature of the Bills is that the illuminating power of the gas to be supplied is almost invariably fixed at 14 candles. The remark which was made during the discussion upon the gas clauses of the Leeds Corporation Consolidation Bill, 1904, by Mr. Boyce, as representing the Local Government Board, that "the candle power is "reduced to 14 in nearly all Bills now," has evidently gone home. Only one of the companies now applying to be incorporated (that of Hitchin) proposes to supply gas of a higher illuminating power—namely, 15 candles—and for this it is possible that the Model Bill is responsible. The Urban District Council of Matlock Bath also propose to supply 15-candle gas in lieu of their present standard of 18 candles. As to how the illuminating power is to be arrived at, there is, as might be expected from the present position of the question, much less uniformity than with regard to candle power. In the majority of cases, Sugg's No. 1 "London" argand is prescribed, used in various ways—in one case so as to "produce a light of 16 "candles." In two cases the burner known as the "Wandsworth" is to be employed; while in others the burner is to be "Sugg's," so constructed as to develop in its use the full illuminating power of the gas of the quality prescribed. There is not an easy task in store for some one if these Bills pass with this provision unaltered. It is evident that, if all these different methods of determining the illuminating power pass into law, uniformity of illuminating power will exist only in name. Gas which is seen to be of 14 candles illuminating power by one of the methods of testing, will only appear to be of 13 candles or less by the other methods prescribed; and hence it is highly desirable that some uniformity of method should be agreed upon, and enacted in all cases. The method proposed by the Metropolitan Gas Companies, and commented upon in our last week's issue, appears to be suitable not only for mixed gas, but also for gases of different illuminating power, which is of importance, seeing that there can be no such thing as finality in regard to 14-candle gas. Gas of this quality can only be regarded as a kind of halting-place. Thirteen candles is, as already mentioned, proposed by the South Suburban Company; while another Company, applying for a Provisional Order, have named 12 candles as the illuminating power they propose to supply.

It was mentioned in a previous article that ambitious schemes for the supply of "power" gas over large areas are this year conspicuous by their absence. The single exception is one which is promoted under the Private Legislation Procedure (Scotland) Act, 1899, for the supply of, presumably, Mond gas from four manufacturing stations in the valley of the Esk, in the county of Midlothian. The provisions of this Bill are on the lines of the South Staffordshire (Mond) Gas Act; the Company undertaking not to supply gas for illuminating purposes, nor power gas to dwelling houses, hotels, victualling houses, shops, places of worship, infirmaries, schools, and museums within the limits of supply of any authority or company lawfully supplying gas therein. The minimum heating value of the gas is to be 125 B.T.U., and the price 3d. and 4d. per 1000 cubic feet, according to consumption. While this new scheme for the distribution of "power" gas is thus being launched, the original South Staffordshire scheme is making way slowly. It is understood the South Staffordshire Mines Drainage Board have recently given an order for a new pumping-engine to be worked with

"Mond" gas, which is only fitting, seeing it was largely due to their support that the scheme was started.

It merely remains to mention that there are only two proposals for the purchase of gas undertakings by local authorities. One of these, promoted by the Otley Urban District Council, is in pursuance of a purchase clause which was inserted in the Otley Gas Company's Act of 1901, and contains the provisions for the purchase which were then agreed upon—one clause including compensation to any officers and servants for whom no regular office or employment on existing terms is found by the Council, and also that the purchase is to be deemed to be by compulsion and not by agreement. The other case is that of the Hessle Urban District Council, who, apparently prompted by the fact that the Hessle Gas Company are applying to be incorporated, seek to purchase the undertaking of the latter. Apparently warned by the high awards which have recently been given as the result of arbitration proceedings, and to which reference was made in these columns on the 26th of July and the 2nd of August last year, the Council seek to fix the basis on which the valuation of the undertaking is to proceed. It is provided that, in the event of arbitration, the arbitrator, in arriving at the price, shall not make any allowance on the ground that the sale is compulsory; and if he finds that the maintainable revenue of the Company exceeds the sum required to yield a dividend at the rate of 10 per cent. per annum upon the capital employed in the business of the Company (after deducting therefrom any portion thereof issued as fully paid to the shareholders by way of bonus or distribution of profits), he shall not take into consideration any maintainable revenue in excess of the sum so required. In so far as this is an endeavour to define the maintainable revenue of the Company as that which the latter could divide if incorporated by the Act of Parliament which they are seeking to obtain, there is much to be said in its favour; but the line must not be drawn too tightly. Consideration must be paid to profits applied to an extension of works, though these do not stand on the same footing as capital actually subscribed for. Some modification in the proposed terms seems to be necessary as to this. Otherwise, the Council are to be commended for having attempted to define beforehand the basis on which the arbitration is to proceed, instead of committing themselves to what recent proceedings have shown to be more or less of a lottery. We are not in favour of these transfers of gas undertakings to local authorities. But, if they have to take place, they should be on such terms as not to put any obstacle in the way of a supply of cheap gas in the future. It ought not to be forgotten that, in sanctioning these transfers, Parliament can have but one object, and that is—not the enrichment of individuals, but the public good.

Carburetted Water-Gas Regulation.

A QUESTION that has been raised by the consideration in another column of a memorandum to the Board of Trade on the subject of the supply of carburetted water gas is as to whether the ensuing session will see a further attempt made to impose upon the suppliers of carburetted water gas regulations conforming with the recommendations of the Departmental Committee of the Home Office in 1899. The memorandum is signed by Mr. C. R. Bellamy, the Lighting Engineer of Liverpool; and the occasion of its preparation and use was the interview which a deputation of the Corporation had with the President of the Board of Trade (Mr. Gerald Balfour) early in December last. The memorandum is sufficiently discussed in the article elsewhere; and the reference here is specially made to warn interested readers of the prospects of a further essay being made in the immediate future to bring carburetted water gas under statutory control, in view of its alleged greater potency for evil as compared with coal gas. Of course, if ordinary care is exercised, consumers are not, as a matter of fact, notwithstanding the larger carbon monoxide content of an admixture of coal gas and carburetted water gas, exposed to any greater peril than they are by the use of simple coal gas alone, or, for the matter of that, of any other artificial illuminant; and therefore we do not see the slightest need for regulation in the manner proposed. While fighting for the release of the gas industry from the restrictive chains forged by unpractical pedants, it would be inconsistent, unless the facts and experiences of the past few years proved a public danger and necessity, to countenance or support any parliamentary curtailment of liberty in another direction. The policy of making and supplying carburetted water gas as a question of economics is, of course, an altogether different matter from this one of regulation. The men of the gas industry can be well trusted, with competitors attacking on every hand, not to stubbornly persist in any action that will bring discredit upon them or their undertakings. Nevertheless, they cannot ignore any sign of a revival of the old attempts to place the industry under fresh and further rule. There is an indication of this revival in the action of the Liverpool Corporation, who have been foremost in agitating this matter for the best part of the past decade, with so far little encouragement. But early last year they saw a ray of that incentive to perseverance in a communication from Mr. Gerald Balfour, who stated that, if the Corporation desired to promote a Private Member's Bill to deal with this carburetted water gas question in the next session—that is to say, the session now approaching—he would be happy to give what assistance he properly could when the time came, and would be glad to meet representatives of the Council during the autumn. The latter part of this suggestion has been fulfilled by the interview with the Liverpool deputation on the 6th ult., one result of which is that Mr. Balfour is going to consider the points placed before him, and communicate with the Home Office on the subject. Have we here the prelude to further parliamentary action? The case for it has certainly not been strengthened by the experiences, taking the country through, of recent years.

Royal Commission on Trade Disputes.

IN addition to the evidence which was given by Sir George Livesey (and which has already been referred to in the "JOURNAL"), a considerable body of testimony has been given before the Royal Commission on Trade Disputes and Combinations, mostly by employers of labour; and there appears to be a pretty general agreement among them with regard to the points which are chiefly at issue. It will be recollected that the Royal Commission was appointed in consequence of the introduction into Parliament during last session of several Bills, each having for its object alterations of the law as regards picketing, and the liability of Trade Union funds for damage sustained through the action of any member or members of such Trade Union. The alterations were to be entirely in favour of Trade Unions, and were devised by them in order to counteract the effect of certain recent decisions of the Law Courts, notably that in the celebrated Taff Vale case. Picketing has always been looked upon by Trade Unions as one of their strongest weapons in the event of a strike; and it does not say much for the reasonableness of their cause that this should be so, seeing that picketing meant intimidation and even violence. It was too often, in fact, a question of the forces of law and order on the one side and of mob law on the other; and the victory was with the strongest for the time being.

Sir George Livesey has related how, when the workmen handed their notices to the South Metropolitan Company in September, 1889, the latter had to give way; but three months later, on the process being repeated, it was the men who were defeated. In the interval, the Company had made their preparations; and when the strike occurred, nearly 3000 mounted and unmounted police enabled fresh men to enter the works unmolested. It may be inferred from these two results that if the power of numbers is to be allowed to prevail, employers who may not be able to command similar aid, will be entirely at the mercy of their employees. The law, however, on this point (and, it may be said, the common sense likewise) and also the liability of Trade Union funds, was so amply vindicated by the Taff Vale decision, that it seems like an act of weakness on the part of the Government to have referred the matter to a Royal Commission instead of meeting the Bills in question with a direct negative. But out of apparent evil, good sometimes results; and it seems already certain that the mass of evidence which is being collected will tell heavily against those who desire alterations of the law. It reveals, in fact, in the clearest manner, the danger that would be incurred by the class legislation proposed.

Among the industries represented is that of the London Master Carmen and Carters Contractors' Association, on behalf of whom it was pointed out that, from the nature of their trade as town carmen, they were unable to afford their employees any protection in time of trade disputes, their

men being scattered in units all over London; and it was essential to the conduct of their business that men willing to work should not be molested or interfered with when engaged upon it. For the Association of Master Lightermen and Bargeowners of the Port of London, was also urged the impossibility of providing sufficient protection for men able and willing to work during a strike. Overwhelming evidence has been given by representatives of other industries showing the character of picketing as conducted previous to the Taff Vale decision, and making it clear that as already stated this expedient was invariably resorted to as a means of intimidation. Sir Andrew Noble, as representing the Engineering Trades Employers' Federation, pointed out pertinently that a single individual could not resist a crowd, and "peaceful "persuasion," when expressed in the words of a dozen men addressed to one man, was not advice but command. The menace of numbers and of movement was greater than that of words. Nor are the objects for which strikes are occasionally resorted to such as can commend themselves to any who entertain respect for individual liberty. The representative of the Shipbuilding Employers' Federation stated that even the recent legal decisions had not resulted in the complete withdrawal on the part of Trade Unions of their policy of doing all they could to prevent the employment of non-Union men. Members of Trade Unions had been known to demand the dismissal of men who formerly belonged to the Unions, but who had got into arrears with their subscriptions. According to another witness, the Trade Unions had "frequently sought to make the employers practically "agents of the Trade Unions, debt collectors for the Unions, "and coercive instruments to compel men to join the "Unions." To sharpen a weapon which may be used for such purposes, would be an act of insensate folly. Each individual firm, as the law now exists, is liable for damages for wrongful acts; there can be no good reason for exempting Trade Unions from the law, and permitting them, in promoting and carrying on strikes, to do acts that are illegal when done by an employer. Such a course, there is but too much reason to fear, would be an inducement to workmen to strike; and existing arrangements for the purpose of avoiding strikes would be imperilled, and conciliation made much more difficult than at present. For it cannot be too fully borne in mind that settlement of disputes by conciliation instead of by strikes is the object to be desired.

On this point, Sir Andrew Noble drew special attention to the arrangements made in the engineering industry for the prevention of disputes by the operation of a mutual agreement, framed in a common desire that work should proceed uninterruptedly, and that the relations between employers and their men should be preserved in amicable terms. In his opinion, the result of this process of conciliation had been a benefit, not only to the employers and workmen immediately concerned, but to the whole trade of the country, and particularly to the engineering industry, in which there was now a feeling of greater security than existed prior to the agreement. He also bore testimony, as have others, to the improvement that has resulted from the recent legal decisions, in a less bitter feeling between strikers and employers, rendering settlement of disputes more easy. It is impossible, in fact, to escape the conviction that alteration of the law as proposed, both as regards picketing and the liability of Trade Union funds, would not only be highly injurious as a precedent, but contrary to the best interests of workmen, no less than to those of the employers. Strikes are, on all accounts, to be deplored—for the misery and want which they inflict, and for the trade they divert; nor can any legislation be regarded with satisfaction which affords to such a barbarous method of settling disputes the slightest encouragement.

Disposing of an Exhibition Grievance.

The unclouded satisfaction that accompanied the gas exhibition from the opening until the closing day, threatened to be then broken on the accounts of the Gaslight and Coke Company being presented to the exhibitors for work executed in connection with the supply of gas to the stands. It was felt that, in some cases, the amounts charged were in excess of what was fair; but the holders of stands—having recognized throughout the exhibition that the Company and their officials had fully and readily done their share towards working for its success—were convinced that the accounts were either capable of explanation or that some mistake had arisen. Representations to this effect were made to the Governor and Board of the Company, who, it is pleasing to learn, have come to an agreement with the Organizing Managers which will relieve the exhibitors of the cost of the auxiliary mains. As a matter of fact, the arrangement for the laying of these auxiliary mains was made with the Organizing Managers, and not with the exhibitors; and certainly an error was committed in agreeing to a suggestion of the former that the cost of the mains should be included in the charges for the fitting work, with which the mains really had nothing to do. It is hoped, however, that any feeling of injustice that may have arisen has now been pacified. If the arrangement has not completely effected that end, it may assist to it on mention being made that we have been fully satisfied that the charges do not cover, by a considerable margin, the expenditure actually incurred by the Company—to say nothing of their donation towards the fund raised by the Advisory Committee of the Institution of Gas Engineers.

To Gas Engineers and Managers.

Our friends who are officially interested in the Question-Box of the Ohio Gaslight Association do not desire to lose any time in securing the co-operation of their British colleagues; and they have made us the willing victims of their anxiety to get to work as quickly as possible, pending the completion of the necessary arrangements with those British Associations (the Southern Association and the Manchester Institution are already taking steps in the matter) who are prepared to identify themselves and take part in the interesting work which the Ohio Association have in hand. By the mail which reached England towards the end of last week, a letter was received from Mr. H. L. Doherty, the Editor of the Question-Box, informing us that he had taken advantage of his friendly relations to constitute the "JOURNAL" office the distributing and receiving centre for the first list of questions prepared for circulation in the United Kingdom. The letter also advised us that Mr. Doherty had already shipped the printed lists of questions, together with a circular for engineers and managers, and the necessary envelopes for circulation and the posting of the replies to the "JOURNAL" office, from which they will be dispatched in bulk to Mr. Doherty. We are pleased to temporarily undertake the work, until a Secretary and Committee are appointed by each co-operating Association to deal direct with the communications from the Ohio Committee. The distribution of the circulars referred to will be made as soon as they are received; but it is very important that the answers submitted should be delivered at this office not later than the morning postal delivery of **Jan. 25,** in order to ensure publication in the 1905 edition of the Association's Question-Box volume. The reason for this short notice on the present occasion is that Mr. Doherty is desirous of getting through his part of the work, and having the replies printed in time for the next meeting of the Association. We ask for, and hope that there will be, a liberal confirmation of the confidence of our American friends that technical co-operation between the gas profession of the two countries would have a valuable result; or, as Mr. Doherty expresses it, in the circular which accompanies the list of questions, they realize "the benefits to be derived from a large field of operations, and the broadening influence of answers given by those who must necessarily view the questions from a different standpoint." What has to be done is for each recipient to choose the questions upon which he can give information, precede the answer to each with the printed number of the question, and append to it his name and address. An answer, of course, is not expected to all the questions, but as many as possible; though, even if a useful reply is only sent to one, it will be very acceptable. But let the answers be as concise as explicitness will permit. All contributors will receive a free copy of the volume of the Ohio Question-Box as soon as published; and we are confident when they see this that they will not regret their share in the work, and that it will produce a growing interest in it in this country. Therefore we ask all gas engineers and managers on this side to show their willingness to co-operate with their American colleagues by sending in to this office answers to as many questions as possible by (or before) the morning of Jan. 25, and so ensure that in the next Question-Box volume the British gas profession will be represented by a long list of names among the contributors.

The Deputation Question Again.

The members of the Stoke Town Council who (as stated in last week's "JOURNAL") found fault with the action of the Gas and Electricity Committees in sending a deputation of members and officials to the recent Gas Exhibition at Earl's Court, may derive consolation from the knowledge that they do not stand alone in the short-sighted position they took up. A section of the members of the Stockport Town Council have also been exercising themselves over the same question. Though the amount involved in this instance was just under £50, one of the speakers expressed his conviction that they had not got value for their money. If that be so, all that can be said is that the deputation must have made very small use of their eyes when in London, for there was many times £50 worth of knowledge to be gained there by those responsible for the administration of gas undertakings. The principal objection, however, appeared to be to the number of members who constituted the deputation. But the fallacy of this argument was pointed out by the Chairman of the Committee, who said that he would not like to go on a deputation without other members of the Committee; for if as a result any machinery was adopted and it proved a failure, the responsibility would then rest upon one or two men instead of upon the majority. The object of the visit to London was stated to be the inspection of stoking machinery and conveying plant; and what the statement that the money spent on this important quest "would feed a hundred poor families for a week" has to do with the matter, we altogether fail to appreciate. It is a poor reward for men who give their services to the management of large public undertakings that the expenditure incurred by them in journeyings in search of useful information should be regarded in the light of needless extravagance by a few of their fellow-members. It is to be feared the discussion at Stockport is only another case of inability to distinguish between a pleasure outing and a business visit. Perhaps the gentleman who complained was surprised to hear from the Deputy-Chairman of the Committee that many large towns were so fully alive to the necessity of obtaining the fullest information regarding improved methods and appliances that they not only sent the whole of the members of their Gas Committees to the Exhibition, but also numbers of officials and workmen.

Municipal Insurance.

Manchester is the latest Corporation to consider the question of municipal insurance; and some interesting facts were brought out in the course of a discussion in the City Council a few days ago. As has been the case elsewhere, dissatisfaction was expressed that the Corporation are paying away to the Insurance Companies more in premiums than they are receiving back by way of claims; and a resolution was introduced admitting the desirability of all the policies being permitted to lapse and the city undertaking responsibilities for fire losses, compensation to workmen, &c.—setting aside the amounts of the premiums now paid to form a fund for the purpose. The proposer advanced the argument that had they done their own insurance for the past twenty years, they would now have had in hand about £20,000. This is all very well, as it happens; but the matter wears a different complexion when it is remembered that during the whole of this period the companies have been under liability to pay enormous sums in the event of a fire taking place. The corporations, in insuring their own property, are taking a risk that no Insurance Company in the world would accept, because the law of averages is of the very essence of the business, and this obviously cannot properly apply in the case of a corporation becoming their own insurers, even though several properties and risks are included. This palpable fact, though apparently overlooked by the mover of the resolution, was fully grasped by another speaker, who referred to the recent fire at the Shoreditch Town Hall, and to conflagrations that had occurred during the past four or five years in corporation buildings at Birmingham, Rochdale, West Ham, Birkenhead, Ayr, Perth, Chester, and Leeds, where losses were incurred varying from £7000 to £64,000. Another member said that though small buildings were not beyond the scope of an ordinary municipal scheme, the larger ones were; the Manchester Town Hall having cost a million of money. Under these circumstances, the Council agreed to an amendment that a Committee should be appointed to inquire into the question as to whether the insurances at present effected by the Corporation should be dispensed with or should be placed on a better basis; the Committee also to consider the advisability of the Corporation joining the Municipal Corporation Mutual Insurance Association, whereby the risks would be spread over a larger area.

Lively Elective Auditing,

It is to be feared that much of the work performed by elective auditors is passed over unheeded by an ungrateful public; but occasionally it does create attention even beyond the particular locality to which it refers. Such has been the case with the recently issued report of the Elective Auditors of Swansea on the accounts of the Corporation for the year ended March 31, which is, to say the least, of a somewhat startling character. It is to be presumed that the gentlemen referred to have made sure of their ground, and that they are able to give chapter and verse for their numerous assertions, though one would prefer to think that they have been mistaken—especially with regard to one of the dealers in machinery who has supplied goods to the Cray Water-Works being "in the employ of a member of the Council." It is, however, true the Auditors say that "to the best of their belief" this is the case; and therefore it is still possible that they are wrong. But the assertion is one that should not have been made if it is incapable of proof; and in the interests of all parties concerned, the matter ought to be fully investigated. Coming to the criticism of the accounts of some of the trading departments (which is of a more definite character), it can only be said that this is such as to give cause for great uneasiness on the part of the ratepayers.

And Some Corporation Accounts.

For instance, it is stated, in so many words, that the financial position of the telephone undertaking, as set out in the annual abstract of accounts, is unreliable, inasmuch as the revenue account has been credited with the whole of the rentals (a large proportion of which remained outstanding at March 31), while the expenditure has only been computed for a period of five months. The profit shown is therefore entirely fictitious, and calculated to mislead those who give the accounts but a cursory examination. They therefore ask the ratepayers to suspend their judgment as to the financial position of the undertaking until a statement is prepared showing a full year's working. But they are even harder on the electric lighting accounts, with regard to the allocation of salaries in which they say it would appear that anxiety to make the face of the accounts wear a too favourable complexion is responsible for the "dubious business policy of squeezing capital to save revenue. Assuming that the revenue account has suffered through the divided energies of the Manager, it can scarcely be urged that the same thing applies right down the gamut of the staff, even to the office boy, a moiety of whose wages is actually debited to capital expenditure." They also call attention to the fact that nothing has been done towards the creation of a fund to meet depreciation and obsolescence of plant during the period arranged for the repayment of the loan; but this unfortunately is too frequent an occurrence to create much surprise. On the top of all these important matters, it is somewhat disappointing to find the Auditors complaining of the presentation to the Mayor of a gold key costing something under £7, on the occasion of the opening of the municipal telephone exchange. Surely "a piece of silly pagan extravagance" is rather a strong term to apply to a customary little ceremony of this nature. That, however, is a small point either way, and does not detract one whit from the striking character of the report. Altogether, it is impossible not to feel a trifle sorry for the ratepayers of Swansea, who, as the Auditors remark, "trudge through life with a fairly heavy burden on their shoulders, and when they die are buried at a loss, for £200 had to be voted from the borough fund to meet a deficiency in the Burial Board account."

Another View of the Commission Question.

The letter from "A Kentish Gas Manager" to "The Times," on the subject of the commission system, to which reference was made in the "JOURNAL" last week, brought one from a correspondent, signing himself "Fair Trade," which appeared last

Wednesday.* In the course of the gas manager's letter, he stated that "a large class of contractors are only too willing to purchase business on these [commission] terms." "Fair Trade," while admitting that there was a great deal of truth in the letter, thinks that on this point the writer went wrong. He contends that the large majority of respectable selling firms deeply regret the present position, and only consent to pay bribes or commission "because they cannot obtain orders on any other terms." In plain words, they are blackmailed by the buyer or his representative. "Fair Trade" calls attention to a form of "hush money" which is more iniquitous than the ordinary commission, and more far-reaching in its effects, and that is where the make of goods to be bought by great trading undertakings, such as gas, water, and electricity supply companies, is stipulated for by some consulting firm of engineers (practically the buyers' representatives), who are directly or indirectly interested in the make of the goods specified. The writer says he could name numbers of such cases; and he cites one to prove that even the Government buying departments are not free from blame in this matter. When this sort of thing goes on in high places, one can hardly be surprised at finding it in more lowly ones. But wherever it exists it must be inimical to fair and straightforward business, and therefore it should be exposed and abolished.

London's Expenditure on Unremunerative Works.

The annual report of the London County Council (which was issued last week) is of special interest to the inhabitants of the portion of the Metropolis which comes under the control of that body, inasmuch as it not only shows the financial transactions for the twelve months ending the 31st of March last, and gives an account of the proceedings of the various Committees, as recorded in their reports, but also enables the student of municipal politics to make himself acquainted with the extent of the Council's operations during the fifteen years of its existence. Though the contents of the report fill nearly 300 pages, it does not take one long to arrive at the conclusion that the Council have been doing some very big work which has entailed a capital expenditure of no less than £23,780,355, or at an average rate of £1,580,000 a year. An ardent advocate of municipal enterprise will, of course, say this is not a very back-breaking amount for such a place as London. Possibly not. At the same time, it must be borne in mind that, of the above-named total, only £5,043,391 has been spent on remunerative works, consisting mainly of tramways and working-class dwellings. The Council have gone in heavily for improvement schemes, especially during the past seven years. Up to 1897-8, the annual outlay on these works did not exceed two-thirds of the average of £1,580,000 already given; but the new century witnessed a substantial rise to £2,236,209. In the twelve months covered by the report, the total expenditure was £3,333,981, of which £1,116,162 was for remunerative, and £2,217,819 for unremunerative works. In the latter total there is an item of £3736 for electricity and gas-meter testing-stations, on which during the past fifteen years a sum of £96,462 has been expended. Technical education cost the Council £74,118 last year; bringing up the total to £94,303. On the 31st of March, London was in debt to the extent of £57,932,101, for one-half of which the County Council are responsible; while its rateable value was only about £41,000,000. Though the proportion of unremunerative capital is so large, the ratepayer may console himself with the reflection that nearly half of it has been devoted to improvements which should make for better sanitary conditions—a feature of Progressivism which few will be inclined to condemn, though it may be a costly one.

* There being a prevalent impression in certain quarters that Mr. T. N. Ritson, the Engineer and Manager of the gas and water undertakings of the Ramsgate Corporation, was the author of the letter in "The Times," signed "A Kentish Gas Manager," he asks us to state that this was not the case, neither had he any knowledge of the circumstances referred to therein.

A quite startling exhibition of the depression which afflicted the freight market last year is to be found in the tables published by Messrs. Cairns, Noble, and Co., of Newcastle-upon-Tyne. According to them, the estimated average rate paid for steamers from the Tyne, Blyth, and Wear declined, in the case of the River Plate, from 17s. 0¾d. in 1900 to 7s. 2¾d. in 1904. The Danube rate dropped from 14s. to 5s. 7½d.; and the Odessa rate from 10s. 6d. to 4s. 9¼d. These rates are typical of the list. They show an almost regular annual decline.

GAS BILLS FOR 1905.

The Gas Companies seeking incorporation in the approaching session of Parliament (whose Bills were under notice last week) predominate among the private concerns applying next session for parliamentary powers; and, if we except the joint measure of the three London Companies, and those of the South Metropolitan and South Suburban Companies, there are only five existing statutory companies asking for additional powers.

First in alphabetical order, there is the Bill of the Croydon Gas Company, who are proposing to enlarge their operations by the transfer to them of the undertaking of the Caterham and District Gas Company. It will be remembered that, by the Company's Act of 1894, the undertaking of the Carshalton Gas Company was amalgamated with that of the Croydon Company; and this considerably extended the supply area of their concern. The proposed absorption of the Caterham Company, if completed, will extend the area to the parishes and townships of Caterham, Warlingham, Chelsham, Chaldon, Farley, and to part of the parish of Coulsdon. The capital of the Caterham Company consists of 2500 ordinary £10 shares, entitled to a maximum dividend of 10 per cent. per annum, and 500 £10 preference shares entitled to a dividend of 5 per cent. In addition, the Company have borrowed £6250 by the issue of debenture stock, bearing interest at the rate of 4 per cent. per annum. The agreement for the transfer is scheduled to the Bill. By this, it is intended that the transfer shall take place on the 1st of July next. To every member of the Caterham Company, there is to be allotted for every fully-paid ordinary £10 share entitled to a maximum dividend of 10 per cent., £10 of ordinary "E" stock, which is to be entitled to a fixed maximum dividend of 10 per cent. per annum (provided that, if in any half year the dividend upon the "B" stock of the Croydon Company is at a less rate than 10 per cent., the "E" stock is to rank *pari passu* with the "B" stock), and for every fully-paid preference £10 share, entitled to a dividend of 5 per cent., the sum of £10 of "D" stock is to be allotted. Provision is made for the limitation, in respect of the half year ending Dec. 31 last, of dividends by the Caterham Company to 5 per cent. on the preference stock and 9 per cent. on the ordinary shares, subject to deduction for income-tax, as well as for the payment by the Croydon Company of similar dividends for the current half year. Excepting as to the rate of interest payable thereon, the debenture stock of the Caterham Company is to rank in all other respects *pari passu* with the debenture stock of the Croydon Company. One Director of the Caterham Company is to be nominated by his colleagues as a Director of the Croydon Company. As compensation for the loss of office, the other Directors are to receive £1500 for division among them; the Engineer and Secretary (Mr. D. H. Anderson) £1000; and the Auditor (Mr. J. C. Benwell), a sum equal to two years' fees. Mr. Anderson, however, is to serve the Croydon Company for two months from the date of transfer if so required; and an agreement may be made with him for the continuation of his services either temporarily or otherwise. In regard to money powers, it is proposed that the Company shall have power to raise, in lieu of the £30,000 of unissued additional capital of the Caterham Company, £36,000 by the issue of "D" stock, to rank *pari passu* with the existing "D" stock of the Croydon Company, and be empowered to borrow (inclusive of the £6250 already raised), in respect of the stocks provided for in the Bill, one-third of the nominal amount authorized. As to the price of gas, in the Caterham Company's district, it is not for seven years from the date of transfer to be more than 8d. nor less than 4d., and, after seven years, not more than 4d., in excess of the price charged for the time being in the district of the original Croydon Company. The clauses in the Bill simply propose to give effect to these and other provisions of the agreement. With regard to the area of supply, however, it is intended that the limits shall be as defined in the two Companies' existing Acts, and shall extend to the parish of Woldingham, and to part of the parish of Godstone. There is also a clause contemplating the repealing of the powers of the Redhill Gas Company within the limits embraced in the Bill. Further clauses provide for the offering of new issues of stock to gas consumers and employees, and to the determining by the Directors of the salary of the Secretary.

The Gaslight and Coke, South Metropolitan, and Commercial Gas Companies' Bill, and the measures of the South Metropolitan Gas Company, and the South Suburban Gas Company, were fully noticed in the "Journal" for Dec. 27 (pp. 985 and 986), and do not require further reference here.

The Shepton Mallet Gas Company are going direct to Parliament for power to supply electricity within their limits of gas supply—including Shepton Mallet and Croscombe. It is proposed to erect the generating station on part of the gas-works site. In addition, the Company desire power to purchase, by agreement, additional lands not exceeding in the whole 2 acres. It is to be stipulated that the plant and works provided by the Company for the purposes of supplying energy shall be kept separate from the gas-works. Power to supply in bulk is desired; and all the necessary authority for conducting an electric light undertaking is provided for. Where the Company charge any consumer by the actual amount of energy supplied to him, they

desire to be entitled to charge 13s. 4d. for any amount up to 20 units, and for each unit over that number 8d. The Company ask to be allowed to grant discounts; but no limit is suggested. For the purposes of the electricity undertaking, they desire to raise £6000 additional capital, with one-third borrowing powers. The standard rate of dividend is to be 7 per cent.; but this is to be varied by ¼ per cent. with reductions or increases of ¼d. in the standard price of 8d. The gas and electricity capitals are to be distinguished, and separate revenue accounts kept.

The Walker and Wallsend Gas Company desire power to acquire additional lands and to construct further manufacturing works. The two pieces of scheduled land which the Company seek authority to purchase comprise together rather more than 20 acres; and, in addition, the Company desire power to purchase, by agreement, additional lands not exceeding in the whole 10 acres. The usual clauses applying to the purchase and utilization of such lands are included.

Another short Bill is that of the Western Valleys (Mon.) Water and Gas Company; and its purpose is mainly to re-arrange the capital and borrowing powers of the Company. By the Western Valleys Water Act of 1891, authority was granted to the raising of £40,000 by shares and £10,000 on mortgage. By the Company's Water and Gas Act of the following year (by which the Risca and Pontymister Gas Company's undertaking was transferred to the present Company), authority was given to the raising of £20,000 of additional capital, and to the borrowing of £5000 in respect of the gas undertaking. Notwithstanding the restrictions imposed by the Acts of 1891 and 1892, which provided that the capital for gas and water purposes should be kept separate, the Company have applied part of the capital authorized by the 1891 Act, and allocated to water purposes, to the completion of their gas undertaking, and have borrowed a greater proportion of money than was allowed by the Act of 1892 in respect of the additional capital, and applied it to both the gas and water undertakings. The Company are therefore now asking for the repeal of the sections of the existing Acts which provided for the capital being distinguished and kept distinct; for authority to treat the two undertakings and the capital as one; and for the money borrowed to be a charge on both undertakings as one. It is therefore proposed that it shall be enacted that the capital already raised and applied to both undertakings shall be defined at the sum of £60,000, and to authorize the Company to raise any balance of the unissued capital, not exceeding in the whole £60,000. The dividend is to be limited to 10 per cent. on the ordinary shares or stock and 5 per cent. on preference shares or stock. As to borrowing powers, the Company desire permission to borrow, in respect of the £60,000, any sum not exceeding £15,000, but no part thereof is to be borrowed until 50 per cent. of the value of the shares or stock at the time issued, together with the premium (if any) realized on the sale, has been paid up.

The Wrexham Gas Bill has for its principal object the conversion and consolidation of the stock and share capital. It is also desired to extend the limits of supply, so as to include the part of the parish of Gresford which is not already within the Company's boundary, and some half-dozen other parishes and townships within the rural district of Wrexham. The conversion and consolidation into one 5 per cent. stock of all the existing consolidated stock and ordinary shares it is proposed shall date from Jan. 1 next. The distribution is to be at the rate of £200 of ordinary stock for every £100 of existing consolidated stock, and for every ordinary share £14 of ordinary stock. The stock is to be issued and be transferable only in amounts of £10, or multiples thereof. Power to raise additional capital to the extent of £40,000 is sought; and, including £12,500 already borrowed, the Company ask to be allowed to borrow up to one-third of the nominal amount of the ordinary stock into which the existing consolidated stock and share capital is consolidated, together with one-third on the additional capital. The dividend on the ordinary capital is to be limited to 5 per cent. Among the general clauses, it is seen that the Company desire power to form a renewal fund by half-yearly appropriations of ½ per cent. on the paid-up capital, until the fund is equal to one-tenth of the latter; to determine the remuneration of the Secretary; to purchase, by agreement, lands not exceeding in the whole 5 acres; and to be allowed to grant discounts within the limit of 20 per cent. The other clauses are all of an ordinary character, excepting one, which proposes the dropping of the word "Light" from the Company's title—appropriately, in these times, leaving it simply as the Wrexham Gas Company.

Of the Bills promoted by local authorities, there is not one that deals exclusively with gas. There is only one that proposes the compulsory transfer of the local Gas Company's undertaking; and one contemplating purchase under clauses secured in the Company's Act of 1901. The former is the Bill (noticed in order below) of the Hessle District Council; and the latter the Bill of the Otley District Council. It will be remembered that the Hessle Company have also deposited a Bill for promotion in the coming session.

Dealing with the Bill of the Accrington District Gas and Water Board, the water provisions will be left for subsequent reference, as far as possible. In the first place, it is noted that it is contemplated to extend the limits of supply of both gas and water, so as to include the township and parish of Altham. In regard to discounts to consumers of gas, the Board ask for liberty to make them upon such scale as they may think fit, provided that rebates to consumers of gas used "for illuminating purposes" shall not exceed 20 per cent. It is also proposed to amend section 30 of the Lancashire and Yorkshire Railway Act, 1896, by which authority is given to lay rails across Hey's Lane, Great Harwood, and to permit the Board to use petrol, steam, electrical, gas, or other mechanical power for moving carriages or waggons along the line of rails leading from the North Lancashire loop line of the Railway Company across Hey's Lane into the gas-works. For the purposes of the gas undertaking, in addition to the £60,042 already borrowed, the Board ask to be empowered to borrow any sum sanctioned by the Local Government Board; and sixty years is the period within which they wish to be allowed to repay the money. In the exercise of powers conferred by section 80 of the Board's Act of 1894, they have made up out of gas revenue and gas reserve fund deficiencies in the water revenue amounting to £22,938 18s. 3d.; and this now stands in the accounts of the gas undertaking as a debt due from the water undertaking. Seeing that it is improbable that this deficiency will ever be made good out of the water reserve fund or water revenue, it is proposed to amend section 80 of the 1894 Act, and to cancel the debt. Power to create a fire insurance fund up to £20,000, and an accident fund up to £10,000 for meeting claims upon them under the Employers' Liability and Workmen's Compensation Acts, is sought.

In the Bangor (County Down) Water and Improvement Act, there is a section referring to gas; but, with the exception of one clause to empower the acquisition of certain lands, by compulsion or agreement, upon which to erect new gas-works, and another to authorize the extension of the limits of supply so as to include as much of the rural district of Newtownards as lies within 3 miles of the boundary of the district, the provisions are of the usual character. Permission is asked to the borrowing, for the purposes of the gas undertaking, of £7000, and such further sum as the Local Government Board may sanction; the period of repayment being 30 years.

Included in the Bury Corporation Bill is a part referring to the amendment of section 7 of the Radcliffe and Pilkington Gas Act, 1854, and to the extension of the Corporation's limits of supply; it being the opinion of the Corporation that they should have the exclusive right of supplying gas within the borough. It is therefore proposed that the powers of supply of the Radcliffe and Pilkington Gas Company shall cease so far as they relate to the supply of gas within the borough boundary, the township and parish of Ainsworth, and a specified part of the urban district of Radcliffe, and that the powers of supply of the Corporation shall be correspondingly extended.

In promoting an Omnibus Bill, the Colne Corporation have taken advantage of the opportunity to apply to their gas undertaking a number of additional powers common in modern gas legislation, and which have for their object improvement in administration. One of the clauses refers to prepayment meters, and is to confer the power of charging an additional 10d. per 1000 cubic feet in respect of prepayment meters and fittings, and 10 per cent. on cost where a meter only is fitted. Regarding discounts, they ask to be allowed to grant up to 10 per cent. for prompt payment, and 15 per cent. for large consumption, or in respect of gas supplied by contract or for motive power. Among the financial provisions is one empowering the Corporation to borrow, with the approval of the Local Government Board, such moneys as may be required for gas-works purposes.

In a substantial Bill deposited by the Halifax Corporation, there are three or four clauses alluding to gas supply which are common to Gas Bills in the present day, and need not be noticed. There is also one [which, however, as announced in the "JOURNAL" last week, is to be withdrawn] proposing to enable the owners of small property to recover gas-rents where, by voluntary arrangement with the Corporation, they agree to pay for the gas supplied to the tenants of such houses, and the tenants agree to pay the owners in respect thereof. The small property owners were all adverse to the proposal; and hence the withdrawal.

In the preamble of the Bill of the Hessle District Council, it is declared that it is expedient that the undertaking of the Gas Company should be transferred to and vested in the Council. It is also pointed out that the Company have, throughout their existence, carried on their undertaking and laid pipes in the streets of the district and in the parish of Anlaby without obtaining statutory powers for the purpose, and have consequently been free from the usual limitations and obligations imposed in connection with the granting of statutory powers to gas companies. In view of this, it is said to be expedient that special provisions should be made with reference to the basis upon which the undertaking of the Company should be valued for the purpose of sale to the Council. In the interpretation of expressions used in the Bill, the word "gas" is defined as meaning "all kinds of gas." In the part of the Bill referring to transfer, it is proposed to enact that, if the Act passes, the Council shall give the Company notice, within three months of that event, of their intention to purchase the undertaking, either by agreement or at a price to be determined by a single arbitrator. It is further provided that, in the event of arbitration, the arbitrator, in arriving at the price, shall not make any allowance on the ground that the sale is compulsory; and if he finds that the maintainable revenue of the Company

exceeds the sum required to yield a dividend at the rate of 10 per cent. per annum upon the capital employed in the business of the Company (after deducting therefrom any portion thereof issued as fully paid to the shareholders by way of bonus or distribution of profits), he shall not take into consideration any maintainable revenue in excess of the sum so required. Further, in the event of arbitration, neither party is to be represented by more than one counsel, or be at liberty to call before the arbitrator more than one engineer and one accountant as expert witnesses in addition to any officers in the regular employment of the parties respectively. If powers to purchase are obtained, the price is to be paid (failing an agreement as to a date) on Jan. 1 or July 1, as the case may be, following next after the expiration of two months from the determination of the amount of the purchase-money. If the latter is not then paid, the Council are to pay 4 per cent. interest; and not until price and interest are paid is the undertaking to be vested in the Council. The Council in another part of the Bill ask for all the necessary authority to enable them to carry on the works. They desire to be empowered to purchase by agreement additional lands to the extent of, in the whole, 2 acres. The price of gas is proposed to be limited to 5s.. with discounts not exceeding 10 per cent. for prompt payment and 20 per cent. for large consumption. The illuminating power of the gas is proposed to be of 14-candle power; and the prescribed burner is to be Sugg's "London" argand No. 1. Provision is also made for the sale of portions of the gas undertaking situated within the districts of other local authorities, but within the Hessle limits of supply. In addition to the purchase money, the Council wish for power to borrow for the gas undertaking £10,500, and for working capital £1500. A period of fifty years is desired for the repayment of the purchase money, and forty years for the sums mentioned above.

The provisions of the London Gas Bill, which is a promotion of the London County Council, were dealt with in the "JOURNAL" for Dec. 27 (p. 985).

The Loughborough Corporation Bill refers chiefly to water and financial matters; and further reference will be made to it in calling attention to the proposed water legislation for the session. Meanwhile it may be noticed that one clause is to confer upon the Corporation the power to refuse to supply electrical energy and gas to any person whose payments are in arrear for the supply of electrical energy or gas or the hire of apparatus or appliances used in connection therewith.

The Matlock Bath Gas Act of 1896 provided that the Council should, within seven years from the date of the transfer to them of the gas undertaking, remove the existing works to a new site. The Council now ask that they shall be authorized to erect new works, and that there shall be a revival of the time for the removal of the old ones. The land to be acquired for the purpose is scheduled. Power is to be taken to enter into agreements with the Midland Railway Company for the provision of railway sidings into the gas-works and the making of a platform or landing-place on the Cromford Canal (which bounds one side of the new site). It is proposed that the illuminating power of the gas, which was fixed at 18 candles in the 1896 Act, shall be reduced to 15 candles. The sum required for the purchase of lands and extending the gas-works is £10,000.

In the Otley Gas Company's Act of 1901, the District Council secured the insertion of a purchase clause, enabling them to promote a Bill for the purpose in Parliament, in any of the next succeeding four sessions, without opposition from the Company, except in so far as may be necessary to protect their interests in respect of the purchase. It was then also provided that, for the purposes of arbitration, the sale and purchase should be deemed to be by compulsion and not by agreement; that the costs of the 1901 Act should be repaid to the Company, as well as those incident to the winding up; and that compensation should be given to any officers and servants for whom no regular office or employment on their existing terms should be found by the Council. In the section of the Bill in which power is sought to carry out the purchase, the limits of supply are defined as including the district of Otley and the parishes of Newall-with-Clifton, Farnley, and Weston. Power is also taken to sell any portion of the undertaking, if they are required to do so, situated within the area of any other authority. Regarding the change of ownership of the concern, the Council are to give notice within six months after the passing of the Act to sell and transfer; and on the 30th of June following the expiration of the six months, the transfer is to take place. All the powers essential to the conduct of the gas undertaking are sought by the Council, who also ask for authority to purchase, by agreement, lands to the extent of 5 acres. The price of 14-candle power gas is limited to 3s. 6d. per 1000 cubic feet. Sugg's "London" argand is prescribed for testing purposes. Ten per cent. for prompt payment and twenty per cent. for large consumptions are the proposed limits for discounts. Borrowing powers to the amount of the purchase money and the costs and charges incident thereto are desired, as well as for extensions and improvements; and for working capital, such sums as the Local Government Board may sanction. It is proposed that the money borrowed for the purchase shall be repaid within forty years; while the money sanctioned by the Local Government Board is to be repaid within such periods as they may prescribe.

The Nottingham Corporation Bill contains miscellaneous clauses referring to the gas undertaking. One is to empower them to make provision out of the revenue of the gas-works or out of the general district rates for the extinction of the gas annuities granted under the Nottingham Corporation (Gas) Act, 1874, by means of a sinking fund appropriated and invested in statutory securities, and with the accumulations, from time to time applied to the purpose, to extinguish the annuities within 75 years from the passing of the present Bill. Another clause is to allow the Corporation to refuse to furnish a supply of gas or electricity to any person who has not paid all gas or electricity rents or charges due from him to the Corporation. Provisions are included as to the construction and placing of pipes between mains and meters, and as to the lighting of private streets.

To their Bill, the Rhondda District Council schedule a piece of land adjoining their existing works in Ystradyfodwg, and containing 2184 square yards, upon which they wish power to erect new gas-works. Beyond this, they ask for authority to purchase, by agreement, lands not exceeding in the whole 5 acres. Sundry other provisions of ordinary application are inserted. For the above-mentioned purposes, the Council ask for power to borrow £20,000, and, with the consent of the Local Government Board, any further necessary sums. Money borrowed under the powers of the Act is to be repaid within forty years; but money borrowed with the sanction of the Local Government Board is to be repaid within such periods (not exceeding sixty years) as may be sanctioned by the Board.

The Tralee District Council, in a General Money Bill, desire to be authorized to borrow for the purposes of their gas undertaking a sum not exceeding £4000 to be repaid within periods, not exceeding sixty years, as fixed by the Local Government Board when granting the loans.

ELECTRIC LIGHTING MEMORANDA.

The Northumberland Clause Question Raised at a Local Government Board Inquiry—Yorkshire Street-Lighting Methods—Unhappy Wimbledon—Free Renewals of Lamps.

THE Torquay Gas Company are responsible for a new movement in defence of themselves and the other ratepayers of the town. The arena in which the struggle has hitherto proceeded over the application of the Bermondsey or Northumberland clauses to municipal electricity adventures has been found at Westminster; but the Torquay Gas Company have set what may become the fashion, in cases where the powers of electricity supply were obtained in pre-Bermondsey-clause days, of appearance being made at Local Government Board inquiries into proposals for further loans for electricity, and the request being preferred that sanction to the loan should be made conditional on the Corporation or District Council giving an undertaking that they would carry on the works under what is known as the Northumberland clause. The Torquay Gas Company laid a request of this kind before the Inspector last week, at the inquiry into an application by the Corporation for sanction to borrow the goodly sum of £42,000 for a new electric lighting and power station. What will be the issue of the application, it will be interesting to see; but the remark of the Inspector that he was inquiring into the scheme upon its merits, and not in regard to any conditions, does not strike one as containing much hope of him according to the Gas Company's application the most gracious countenance. But it is not an unknown thing in recent times for the Local Government Board to look a little more closely than of old into applications from the point of view of how the ratepayers are likely to fare financially in respect of the scheme for which the money is required; and so we will not take it for granted that their decision in this particular instance will be adverse to the Gas Company's suggestion. The Company are quite justified in their action by the financial results of the electricity undertaking up to the present time. Since its start, the Corporation have been able to put by the not particularly handsome sum of £300 to reserve fund! As the Inspector states, the present proposed expenditure is a big one; and there is the likelihood, upon the scheme being carried through, of a deficit on the undertaking. It is true that the Corporation have entered into an agreement with the Dolter Electric Traction Company for the supply of current to them; but this is one of those "heavy load factors" for which a modest price per unit is charged. The present generating station has been sending out current for private consumers at the (according to the returns in an electrical contemporary) average price of 5·33d. per unit, and for public lighting at 3·98d. per unit. If these are the prices ruling now, if the Town Clerk is correct in stating that at the present station it is not possible to meet any increased demand for electricity, and if under these combined circumstances the concern has yielded on the trading only the miserable "reserve" of £300, what are its prospects when saddled with a weighty addition to the capital, and a large business for tramway use at a much lower price than present charges, by which the Corporation have only just been able to make both ends meet? Undoubtedly the prospects are that either there will be a deficit for the ratepayers to make good, or the private electricity consumers will see the demands upon them brought up nearer to the maximum price. It was rather a good point that was made by Mr. Easterbrook, who appeared at the inquiry on behalf of the Company, that, "if Parliament gave power to the Corporation to charge a maximum (say) of 8d., it was common sense to say that Parliament intended that this

maximum should be attained before seeking to charge those who did not use electricity by asking them to make up the deficit." The Torquay Gas Company and their Engineer (Mr. R. Beynon) were last session very active over the electrolysis question in connection with the Dolter tramways scheme; and this new endeavour shows that no opportunity is going to be lost by them to protect their property, business, and interests generally.

A very fine study is afforded, by an article in the "Yorkshire Post" on "Electric Street Lighting in Yorkshire," of the unsettled views of the municipal rulers of that county on the question as to which is the most economical and efficient method of street illumination—gas or electricity. But, reluctant as the writer is to admit it in plain words, the article shows conclusively that the balance of favour is on the side of gas, and that, generally speaking, the fervour of municipalities for electric street lighting is on the wane. This we are not surprised at in the case of long-headed Yorkshiremen, who as a rule, in matters of business, are in the habit of seeing twenty shillings' worth for every sovereign they spend. The article in question has evidently been prepared as a defence of a decision in Leeds to indulge in the extravagance of lighting by electricity instead of gas the chief tramway thoroughfares for a radius of a mile from the centre of the city, and thus nearly treble the present number of arc lights. When the work is finished, Leeds will have some 650 arc lamps in its main streets, which will be a number far in excess of any other Yorkshire town. At present, there are 250 arc lamps in use; and for the electricity last year £4406 was spent, as compared with £22,548 for the gas required for the whole of the remainder of the streets included in the lighting area. If 250 arc lamps ran away with £4406 worth of electricity, it is not a very hard calculation to find out that the 650 lamps will involve an expenditure for current equal to between £11,000 and £12,000; and this is putting the arc lamps on very favourable terms. The writer of the article states that the Electric Lighting Department are able to keep the arc lamps going for as little as 1¼d. per unit; "the cost working out at practically no more than gas." The comment of the intelligent ratepayer upon this, when the accounts are published after the first year's working, if he is permitted to compare the old with the new total for lighting, will be the epigrammatic one of "rubbish!" Apart from the question of working costs, there is the initial expense of making the change from one system of lighting to the other; and, in the interests of the general tenor of his article, the writer wisely refrains from alluding to this. Appeal in support of the change is made to the views held by the magnates of Shipley; and it is pointed out that Barnsley and Heckmondwike are so impressed with the effectiveness of electricity, that they are contemplating extensions. Wakefield also finds electricity useful; and in their particular circumstances, neither less effective nor more costly than gas. Against this comparatively insignificant showing, we have Oldham, where the authorities have come to the conclusion that incandescent gas can be used at one-third the cost of the electric light of the same power. Bradford, too, finds a vast difference between the cost of gas and electricity. In Sheffield, the whole of the street lighting is done by gas; and there is no present intention of introducing electricity for the purpose. The experience of Hull is that arc lamps are too expensive for general lighting. In Halifax, the cost of lighting by electricity is at the rate of £849 per mile, as compared with £57 per mile for 190 miles of streets illuminated by gas. Both systems seem to give public satisfaction; but here again there is the feeling that incandescent gas lighting is the more effective and economical of the two. Huddersfield confine their electrical street lighting to a small area in the centre of the town. We shall not be at all astonished to find that the experience of the cost of this large extension at Leeds will satisfy both councillors and ratepayers for many years—if not for aye.

The Wimbledon District Councillors and the ratepayers are unhappy over their speculation in electricity works. The breaking down of the plant is a matter of "frequent occurrence." The people who honour the district by residing in it pay £6000 a year for street lighting, yet one councillor, at the last meeting of the local rulers, compared the electric lights in the streets to "rush lights," which, to say the least, was rude of him. Rather late in the day, it is recognized that, by the adoption of the incandescent gas system, practically £2000 a year could have been saved; and the opinion is that the lighting would be very much better. This, however, is not the worst feature of the story. In 1902, the debt on the electric lighting undertaking was about £71,000; to-day, it is £135,000. There is a proposal now to extend and improve the works, at a further outlay of £25,000; the Electrical Engineer (Mr. Tomlinson Lee) confessing that "the present conditions are most unfavourable." One of the members of the Council, with the view of averting this immediate expenditure, has suggested the cessation of the public lighting by electricity; so that the electricity consumed in the streets may be turned into more profitable channels. This would afford temporary relief; and it would be even worth doing to save the ratepayers £2000 a year useless expenditure. We present to the Council the suggestion that this saving of £2000 would about pay interest and sinking fund on the amount required for extensions. What is going to be done has not yet, we believe, been determined. When the discussion took place to which reference has been made, the members thought they would like to further turn the subject over in their minds; and then debate it again. Such experiences as these of Wimbledon should assist those smaller authorities who are in these days the special objects of the attentions of the expert electrical tout, in coming to a right conclusion.

As an instance of the new movement among electricity purveyors now that the dream has passed that customers would flock round their doors directly they were opened, reference may be made to a notice issued by the Twickenham and Teddington Electric Supply Company, Limited. The Directors find it necessary to offer inducements to get and keep business. At present, the consumer has the option of being charged upon the maximum demand system at the rates of 7d. and 3d., or, as an alternative, at a flat-rate of 6d. per unit. As was remarked last week, the more consumers know of the maximum demand system, the less they like it; and many electrical undertakers have thus found it necessary to keep a double system of charges going, so as to give consumers a choice. However, the point is this, that the Twickenham Company have not only decided to reduce the flat-rate of 6d. per unit to 5½d., but consumers on this system are to have the privilege of free renewal of lamps. They are to be allowed to exchange them as often as they wish; the only condition being that the old lamps are to be returned when the new ones are supplied. Is this concession a result of liberality or of necessity? We trow there is really more of the latter about it than the former. The Directors state that they have been induced to make the concession, as they find the lamps are retained in use a long time after they have become very inefficient; and that nearly all complaints of poor light arise from this cause. It is the general experience that electric incandescent lamps rapidly deteriorate. It used to be the custom for electricians to gibe at the incandescent gas mantle. But they have learnt since that a decrease of light in the case of an incandescent gas-burner is more often than not only a warning that the burner requires cleaning; and this a consumer can do without expense. When, however, the light is a decreasing quantity in the case of an electric incandescent burner, the only thing the consumer can do is to purchase a new one, or to pay a heavy price per unit for electricity in order to obtain the "free" renewal of lamps. What a blessed word is "free;" but what deceptive uses can be made of it? It is seen from the notice suggesting these remarks that the electricity prepayment or slot meter rate of 7d. also includes "free" renewal of lamps.

THE GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 113.)

THE Old Year had closed on the Stock Exchange most brightly and cheerfully, and with every promise that the New Year would witness a buoyant reopening. But nothing is certain, except the unexpected; and a rude disappointment was in store. Apparently the fall of Port Arthur on New Year's Day had an almost bewildering effect, and operators could not decide how to act. Dullness set in; and realizations wherever a profit could be snatched were the rule. And so prices shrank. Another perturbing factor arose from the pronounced ease of the Money Market. Excesses tend to bring about their own cure, and, in this case, too many candidates to absorb the welcome plethora presented themselves at once. Markets in general are nowadays much more sensitive than they used to be; and movements are quick and spasmodic. So that it did not take long to bring about a position that was rather disquieting to the many who had been calculating upon getting all the money they wanted. Things will, no doubt, straighten out all right; but the first week of the year was not altogether a happy one. Business in the Gas Market was quite as active as it has been of late; there being a large number of transactions in the issues of the two chief Companies. The probable profit-snatching to which we pointed last week began in earnest; but only one issue was affected, and all the rest were very firm. The affected issue was Gaslight and Coke ordinary, which, after marking 103⅜ on the opening day, fell to 101¼ on Thursday and Friday. But it was firmer on Saturday, and touched 102½. The secured issues were strong and active. The maximum changed hands at from 93 to 94; the preference from 110½ to 111; and the debenture from 87 to 87½. In South Metropolitan, there was much more activity; and prices were good enough to warrant an advance in quotation. On the opening day, 132½ was marked once; but all subsequent transactions were between 133 and 134. Not much was done in Commercials; but prices were good—the 4 per cent. commanding 119; and the 3½ per cent. 114¾ and 115. There were a few dealings in the Suburban and Provincial group coupled with advances; Liverpool "A" and Wandsworth "B" being conspicuous. Brentford old marked 251, and ditto new 191. British was done at 41; Bromley "B" at 93½; and South Suburban at 125. West Ham ordinary marked 101½, and ditto preference 123½. The Continentals were quiet but firm. Imperial changed hands at from 210½ to 213, and Union at 116½ and 117. European fully-paid was done at 21½, and ditto part paid at 15. Among the undertakings in the remoter world, Buenos Ayres ranged from 11⅜ to 11⅝; River Plate was done at 12, and ditto debenture at 95. Primitiva ordinary marked 5 7/16 and 5 9/16, and ditto debenture 95. Monte Video marked 10¾. Cape Town had an advance, and changed hands at from 16 to 16½.

The closing quotations are shown in our stock and share list.

URGING LEGISLATIVE CONTROL OF CARBURETTED WATER GAS.

THE action which the Liverpool Corporation have taken in connection with the question of the supply of carburetted water gas by the Liverpool United Gas Company has, to say the least, been consistent in respect of its persistency. The question which has at times been raised, privately if not publicly, as to whether the motives which prompt that persistency are purely and exclusively of a public character, or have as an underlying incentive a certain amount of animosity to the Company, is a matter which we need not discuss here; but it cannot be overlooked, in this connection, that of 91 authorities in whose districts carburetted water gas is supplied according to the returns for 1902, the Liverpool Corporation stand alone in keeping alive the agitation for the regulation of the supply of water gas, notwithstanding that there are gas companies in other districts distributing an equally large proportion in their supplies. Nor does it help their case, when it is pointed out that there are 28 authorities who are themselves guilty of what is, in the eyes of the Liverpool Corporation, the heinous offence of distributing carburetted water gas, and yet do not find it necessary to take action against themselves by scrapping their plant, and that, in addition to Liverpool, there are 62 gas companies supplying carburetted water gas, and the authorities find no occasion to concern themselves in the matter. These are facts which, in the discussion, it is clear, fairness claims should not be ignored. Disagreement on economic grounds, both from the manufacturers' and consumers' points of view, in the matter of the supply of carburetted water gas, we have entertained and given expression to; but with respect to the necessity of regulation, that we have steadfastly set our faces against, in the absence of conclusive evidence in this country that there is any necessity for it. At the same time, the infliction of restrictions as to the carbon monoxide content of power or producer gas for distribution for manufacturing purposes, the Memorandum of the Home Office on the subject of the use of water gas and producer gas in industrial establishments, to say nothing of the interests in other respects of gas consumers, have induced us to counsel moderation in the supply of carburetted water gas as the best means of preventing, if the suppliers do not desire it, the bringing down upon themselves of the regulation which the Liverpool Corporation are still urging should be applied to the distribution of the gas. Those who think they can comfortably ignore this militancy on the part of the Liverpool Corporation as being solely directed to the Liverpool Gas Company, should not continue to delude themselves. If the repeated attacks from Liverpool should have any effect, local though the inciting causes of the action may be, the result would have general application; and the Corporation do show at least one sound line of reasoning in this matter in recognizing that a controlling hand can only be laid upon the Liverpool Gas Company through general legislation. This was made abundantly plain by the Lord Mayor on the occasion of the interview that a deputation from the Corporation had with the President of the Board of Trade (Mr. Gerald Balfour) just recently, when he said, so runs the report, that this "question was a national rather than a local one; and he ventured to suggest that it was worthy of the most serious consideration of His Majesty's Government." In short, the whole object of the deputation was, in the Lord Mayor's own words, to impress upon the President the views of the Corporation on the subject of promoting legislation for regulating the supply of carburetted water gas. It is, however, conceivable, if Mr. Gerald Balfour's high position permits him to possess a modicum of humour, that he saw another side to the deeply shaded picture presented to him in looking at the constitution of the deputation before him. According to the report which appeared in the local Press, the deputation was composed of "the Electric Light and Power Committee of the Liverpool Corporation and the principal officers." One might well be pardoned, therefore, for thinking that the deputation was not altogether disinterested apart from the question of the danger to the community which the members saw in the considerable introduction of carburetted water gas into the principal commodity of the Company.

The report referred to speaks of a "memorandum" which was prepared by the City Lighting Engineer (Mr. C. R. Bellamy), and which was from the beginning almost to the end a confession of abortive endeavour to put the gas industry under restraint in this matter. Commencing with an announcement that carburetted water gas was not adopted on a commercial scale in this country until 1891, Mr. Bellamy showed Mr. Gerald Balfour, by a tabular statement compiled from the Board of Trade returns relating to gas undertakings, that, although thirteen years have passed only 91 (or 12·8 per cent.) of the gas undertakings of the country have adopted the system in conjunction with their coal-gas supply. But he showed something else, and it was that, while the average percentage of water gas in the general supply of the manufacturing local authorities is only 14·25, in the case of the companies it amounts to 24·45. Not only have fewer local authorities than companies adopted carburetted water gas, but the percentage in the mixture sent out by the former is considerably less. We have taken the trouble to look this matter up in the last issued Board of Trade returns—those for 1902-3. It must be admitted that companies whose maximum percentages of carburetted water gas exceeded in the year one-third of their total output of gas, formed a goodly proportion of the list of those who make it; while, of local authorities supplying carburetted water gas, the number whose maximum was above 30 per cent. was very few. Of course, the maxima are far from representing the normal proportional output; and it would perhaps be to the advantage of all concerned if, in the returns, not only the maximum percentage but the average were stated. Looking through the returns has brought to notice again the note attached to the Lincoln figures for 1902-3 that, while the maximum proportion of water gas was 33⅓ per cent. in the day time, none was sent out during the night.

However, the memorandum of Mr. Bellamy refreshes the memory as to the history of the supply of carburetted water gas in Liverpool; and as to the action taken by the District Council and residents of Garston, following the cases of gas poisoning there, between 1895 and 1897. In showing what led up to the appointment of the Departmental Committee of the Home Office towards the close of the nineties, Mr. Bellamy seems to draw somewhat upon his imagination when he says that, cases of gas poisoning having also occurred in other towns in connection with gas poisoning, "general alarm" appears to have been created. The alarm was distinctly of a localized character; and it is a silent, yet significant, criticism of not only the agitation that brought into being the Departmental Committee, but of the report of the Committee, to be in a position to write six years after the inquiry that no action other than of an introductory and fruitless nature has ever been taken on the report, and that the freedom which the manufacturers of carburetted water gas have since had, and the greater quantities of water gas distributed, has not produced the evidence to show that—given sound fittings and the simple care that is necessary in the use of paraffin, matches, fire, or coal gas—there is any more danger in the distribution of a proportion of carburetted water gas in the general supply than in the distribution of coal gas alone. Now in Liverpool, between 1895 and 1904, there were eight cases of gas poisoning; and of those eight only six were fatal. One death was due to "a combination of alcoholic and carbonic oxide poisoning;" so that we have remaining five cases only in ten years of fatalities from gas poisoning alone in Liverpool. For such a city as Liverpool, no one can pretend that the number is surprising. And further it does not lend much aid to the case of the Corporation to find that between Nov. 11, 1900, and Feb. 11, 1904, there was not a case of gas poisoning in the great city, save that of the combination poisoning case of Jan. 5, 1901, already referred to. Yet during these latter years, the quantity of carburetted water gas sent out has increased; and we have in the returns for 1902 the high maximum of 50 per cent. mentioned, but there was no case of poisoning then. The truth is that, on the facts presented, the case for regulation, so far as Liverpool is concerned, has been considerably weakened since the inquiry of 1898.

The references in the memorandum to the passages between the Corporation and the Company are now somewhat of the nature of ancient history; but we may just glance at the steps taken by the former subsequent to the departmental inquiry to urge the authorities to promote legislation, and the little encouragement they obtained for their pains. It was in 1902 that a Special Sub-Committee, appointed to consider and report upon the use of carburetted water gas in Liverpool, recommended the Council to ask the Home Secretary to receive a deputation on the matter, with the view of urging upon the Government the desirability of introducing a Bill to carry out the recommendations of the Departmental Committee. The Government, however, at the time had a Bill in the House of Lords, having for its purpose the "Regulation of the Supply of Water Gas and Other Poisonous Gases;" and so the question of a deputation was not then proceeded with—it being determined to await the progress of the Government measure. Stress of public business, it will be remembered, led to the abandoning of the Bill; and then there followed a period of inaction. The question was re-opened by the Liverpool Corporation in January of last year, when, in a letter from the Board of Trade, it was stated, on behalf of Mr. Balfour, that he feared the Government could not undertake to reintroduce the Bill during the then next session; but they would be pleased to consider the terms of a private member's Bill if one were brought in. Accordingly, the necessary steps were taken; and Mr. W. Watson Rutherford, M.P., undertook the charge of such a Bill. But, after making inquiries, he informed the Town Clerk of Liverpool that it would be absolutely impossible to get the Bill through Parliament that session as a private member's Bill. After the long lapse of time—three years—there was another death (that of Jane Gressier) from gas poisoning, through an escape from a gas-stove, on Feb. 11, 1904; and thereupon activity was renewed. The Town Clerk communicated with the Board of Trade on March 22, stating that the Lighting Committee were most anxious to know officially from the Board whether the Bill if introduced had any chance of becoming law that session—Mr. Balfour's attention being again drawn to the importance and urgency of the matter, as evidenced by the further death, "owing to the insidious and poisonous nature of the gas." A reply was received on March 26, stating that Mr. Balfour considered that a private member's Bill dealing with a subject of this character, and introduced for the first time at that period of the session, would have practically no chance of passing; and he regretted that he could not deal with the subject in a Government

measure. The Corporation Health and Lighting Committee pressed for an interview with the President in April. A reply was received stating that it was practically out of the question to deal with the matter that session; but *if the Liverpool City Council desired to promote a private member's Bill on the subject next session, Mr. Balfour would be happy to give what assistance he properly could, when the time came*, and would be glad to meet representatives of the Council during the autumn. Of the whole of Mr. Bellamy's memorandum, we consider this statement the most important in its significance. The deputation on the 6th ult. was the result. There, for the moment, the matter rests; and we have now to see whether there is going to be any immediate development on the lines of Mr. Balfour's suggestion as italicized above.

There are two or three other points in the memorandum which have a suggestive interest. Tests of the gas supply have been constantly made during the years of this Liverpool agitation; and following the death on Feb. 11 of last year, Dr. Brislee, of the Liverpool University, analyzed 24 samples of gas taken from eleven parts of the city over a period of fourteen days. Mr. Bellamy states that, in reference to one of the districts, Dr. Brislee remarked that the gas supply is "unnecessarily and seriously poisonous—the danger from an escape of gas increasing in much greater ratio than the percentage of carbonic oxide." The percentage of carbon monoxide in the district was 16·6, which corresponds to 40·8 per cent. of carburetted water gas. Following this comes the statement: "Tests have been made from time to time to ascertain the soundness of gas-fittings in ordinary dwelling-houses in Liverpool, with the result that, in no instance, would the fittings have passed the test applied in America. The highest leakage found was 2⅔ cubic feet per hour; and the lowest in a dwelling-house of ten apartments, where the loss was only 0·024 foot per hour." These statements, considered in conjunction with the fact that there has only been one death since Jan. 5, 1901, do not form a particularly strong indictment of carburetted water gas in admixture with coal gas as a dangerous article for general distribution. We should not be surprised to learn that in Liverpool since January, 1901, oil-lamps have claimed more victims than this single one, which is chargeable more to the defective tap of a gas-stove than to the carburetted water gas. Another point is that if the gas-fittings of Liverpool are in such a deplorable condition as Mr. Bellamy affirms, is it not rather the gas-fittings than the gas supply that require attention? the inquiry being emphasized by the fact just mentioned that the only death since 1901 was due to an escape through a defective gas-tap. Before the introduction of carburetted water gas, there were deaths from coal gas poisoning through defective fittings; and there is the danger that there always will be while they exist, no matter what the composition of the gas.

This question of defective gas-fittings bears upon that of gas supply by means of the prepayment meter system. Mr. Bellamy appears to regard the spread of this system as increasing the risk where carburetted water gas is supplied; we regard the system as a protection to the poorer classes in the use of gas in their dwellings. This is what Mr. Bellamy says: "It may be pointed out that the number of consumers amongst the working class population has increased enormously since the introduction of carburetted water gas in 1895, chiefly as a result of the introduction of the prepayment gas-meter. In the case of the Liverpool Gas Company, the number of such consumers has increased from 11,300 in 1895 to 29,000 in 1902. There is obviously a largely increased risk in connection with this class of consumer, as the gas is used in smaller rooms, and in cold weather very frequently is left burning with door and window closed, for the purpose of heating the apartment." Mr. Bellamy does not say whether the tests that have been applied to ascertain the soundness or otherwise of gas-fittings have been carried into the houses of prepayment meter consumers. We question it. It must not be overlooked that, as a rule, in the case of the prepayment meters, the gas suppliers themselves put in the fittings; and therefore, if sound gas-fittings are to be found anywhere, it should be in the houses of prepayment meter consumers, which are not only put in by the Company, but constantly come under the observation of their officials. These consumers are therefore better protected than any other class. Can Mr. Bellamy say whether any of the five or six cases in ten years of fatal gas poisoning in Liverpool have occurred in houses of consumers on the prepayment meter system? If he cannot, his attempt to excite the sympathy of the authorities for his cause by reference to the working class population and the prepayment system is not particularly tactful.

One more point, and we have done with this comment on the memorandum presented to the Board of Trade. It is stated that the number of deaths reported by the Registrar-General as being due to coal gas in 1890, the year before the introduction of water gas in this country, was seven; in 1894 (the year before the introduction of carburetted water gas in Liverpool), eleven; and in 1901—the last available returns—24. In the twelve years covered by these figures there was an increase in the number of gas consumers supplied by companies and local authorities of no less than 1,623,714—that is to say, whereas the number of consumers in 1890 was 2,297,278, in 1901-2 the number had risen to 3,920,992; and we do not hesitate to say that the population represented by the consumers had increased in that period in greater ratio. In those years, too, the consumption of gas had advanced from 94,645,613,000 cubic feet to 144,058,556,000 cubic feet, or by 49,412,943,000 cubic feet. A low or high number of deaths in particular years may be purely fortuitous, and cannot be brought to bear as any evidence of an increase of danger by a change in the constitution of the gas, or serve any purpose as a comparison, in view of the greater and more general use of gas. The deaths in Liverpool amply justify this view; seeing that since 1900 there have only been two deaths at Liverpool—one the death from a combination of alcoholic and carbonic oxide poisoning, and the other the death through an escape from a defective gas-stove, yet since 1900 the Company have installed further carburetted water gas plant, and sent out daily much greater quantities.

Therefore we do not see the necessity for regulation, whatever may be the views harboured by us in common with many others as to the economic aspects of water gas, and its utility in comparison with coal gas from the point of view of the consumers.

TRADE UNIONS AND THE UNEMPLOYED.

In an "Editorial Note" last week, we commented on the aims and objects of Trade Unionism as these stand revealed in the report of the Trade Union Conference on the present scarcity of employment. The remedies proposed for the latter which are contained in this report are scarcely less open to objection; but they have a tinge of practicality just sufficient to redeem them from the charge of being wholly visionary and impracticable. The idea that the Government should be urged to regulate the distribution of their work so that the necessity to discharge men will be obviated, and that they should urge this principle of regulating the distribution of work upon all public bodies and recommend it to private firms, and also that the practice of working overtime should be generally discountenanced, can scarcely be regarded seriously. It assumes the possibility of so regulating public work and private trading as to cause these to take an even course, varied only by the exigencies of population—that is to say, work and trade must be of sufficient volume to give steady work for all, and must only increase as the population increases; any backward movement, apparently, not being contemplated. This is, as everyone knows, an ideal state of things which is altogether impossible of attainment, even if—to speak metaphorically—a sluggish stream is preferable to one which swiftly ebbs and flows.

War, for example, always means additional employment which cannot be anticipated in times of peace; while if wars should cease, how is the ordinary expenditure upon armaments to be in any way reduced without throwing workmen out of employment? Again, the Birmingham Corporation, one of the public bodies referred to in the report, have been busily engaged during the last few years in constructing new water-works on a gigantic scale. These have found employment for an army of workmen, who will shortly have to seek another job. How would the Trade Unions deal with such a case as this, so that "the necessity to discharge workmen will be obviated?" If it be once admitted, as a cardinal principle to govern public bodies, that the discharge of workmen is to be obviated, abuses are bound to follow. There will be practically no end to the already too lavish expenditure of public money. Nor can it be any part of the duty of a Government, as understood in this country, to urge such a course upon all public bodies, or recommend it to private firms. The latter would naturally resent any appearance of interference by the Government at the instigation of Trade Unionists who, it may be said, have their own axes to grind, since the non-discharge of workmen means to them a saving in the amount paid for unemployed benefit. So long, however, as private firms can obtain work, they do so, as a matter of course, rather than discharge workmen; and the more useful a workman is able to make himself, the more remote becomes the possibility of his discharge. But Trade Unions desire to reduce all to one level of usefulness; and the more they get their way in this, the less likely are they to succeed in obtaining recognition of the principle which they now advocate—namely, that the necessity to discharge workmen should be obviated. They cannot have it both ways. They cannot extort consideration from an employer while giving him less than nothing in return.

The report goes on to suggest, as a means of employment, "that works of public utility be carried out with the least possible delay, such as that proposed by the Government last session relating to the Port and Docks of London and the improvement of the Thames, coast protection against the encroachment of the sea, and general reclamation of the land saved from such encroachment; necessary harbour works, and work already decided upon in connection with the postal and other Government departments; and the acquisition by the Government of waste land at present unfit for agricultural purposes, with a view to afforestation." It also recommends that the practice followed by public bodies, of refraining from putting work in hand during the winter months, be as far as possible modified; and that public bodies acquire land to which the unemployed may be drafted with a view to the workers and their families eventually becoming self-supporting through a system of co-operative farming. These, it will be seen, constitute what may be called a very large order; and long before the works referred to could be made available as a means of employment, it is possible (and certainly greatly to be hoped) that the necessity for them may have passed away.

Fortunately, the weather continues sufficiently open to admit of outdoor work being proceeded with; and there are distinct and gratifying signs of improvement in trade. It is true that the expenditure by local authorities upon public works has received a check from which it may not soon recover; but other expenditure will take its place when the public confidence is sufficiently restored.

In the meantime, it is as well to recollect that work which is hastily conceived and executed is seldom of any lasting benefit. A great deal of relief may, however, be at once afforded by the pressing forward of work already determined upon, or which it is certain will be required in the immediate future. In this connection, the example of the First Garden City Company may be cited. They have undertaken to find work for the unemployed upon their estate in advance of their present requirements, to to the extent of any subscriptions they may receive for this purpose—such subscriptions to be exchanged for stock of a like amount in the Company. One lady has subscribed £700 with this object, and further subscriptions are invited. This is not a course that can be very generally followed, since the circumstances are almost unique. But it is open to every trading company or local authority to avail themselves of a period of low prices for the execution of work or the provision of plant likely to be required in the immediate future. Doing so, would be rendering material assistance at a time like the present, while also benefiting their undertakings. For gas-works in particular, there could, as regards prices, hardly have been a better time for making contracts for extensions than the last few months.

LOCAL TAXATION AND REPRESENTATION.

Quite a little flutter has been caused in the municipal dovecotes by a suggestion which appears in the current number of the "Contemporary Review"—and it is not to be wondered at that this should be so, seeing the revolutionary nature of the proposal. The author is Sir Robert Giffen, K.C.B.; and it is after considering the question of "Local Extravagance and Imperial Burdens" that he puts forward the view that an improvement in the existing methods of local finance might be secured "by the infusion into our present system of having the local bodies elected by the ratepayers, each person being counted as equal, a system of representation according to interest, the chief landlords of each district or town having a special representation."

When the fact is borne in mind that at the present time there are very many large ratepayers who have no control whatever over the spending of their money, it seems altogether too much to regard the above proposal as possessing even a "sporting chance" of ever being carried into effect. One man one vote, and one company no vote, is the existing state of affairs; and a modification of this principle to the extent of granting to the latter an equal privilege to that enjoyed by the former, is the most that can be reasonably expected at present—and perhaps even this may be more than will be granted. While the taxation of enormous amounts of property entirely without representation is grossly unfair, a "system of representation according to interest" would be going to the other extreme. It is quite true, as argued, that the chief landlords of a place have a direct interest in economy which ratepayers generally do not possess; but there are many other considerations to be taken into account. Economy is most desirable—it has now even come to be absolutely necessary; but it is not everything. For the present at all events, however, the proposal appears to be outside the range of practical politics; and therefore there is no need to discuss it further. The serious aspect of the matter is that Sir Robert Giffen (who himself admits that his remedy is much against ruling prejudices, though he denies that it is inconsistent with democratic ideas or ideals) should think that local finance has reached such a pass as to necessitate the drastic proposal he puts forward.

What, then, is the nature of the arguments that have led the author to make the suggestion referred to? In the first place, there is the fact that for the year 1901-2 (the latest year included in the official "Statistical Abstract") the local expenditure of the United Kingdom was four times what it was forty years ago, while the revenue has not increased in the same proportion; there having been a rise of £108,000,000 in the expenditure, as against a growth of £75,000,000 in the revenue. The explanation of this is, of course, to be found in the rapid rate at which money has been borrowed by these bodies; and Sir Robert's conclusion is that, while in the matter of imperial finance we are still very much as we were forty years ago, with regard to local finance "we have been apparently extravagant, and have eaten somewhat, if not largely, into the resource of credit available for imperial purposes and emergencies." At the same time, he admits that, large as the figures are, and however great the revolution that has occurred, there is a good reason in substance for a large expenditure by local authorities in a country like the United Kingdom; and that it was reasonably to be expected in a progressive community, in spite of the drawbacks which it entails. The question is whether it has been overdone; and his researches lead him to the conclusion that the growth of expenditure in certain directions is disquieting in no small degree, even though the borrowing, "where borrowing is necessary, does not touch upon the resource of credit any more than would the borrowing of private traders, whether companies or individuals, by whom the work must otherwise be done." This latter statement has, of course, been hailed with delight in certain quarters, where perhaps sufficient regard has not been paid to the saving clause "where borrowing is necessary." The reason for this qualification, however, is the author's opinion that the expenditure of local authorities is partly extravagant and unnecessary, because they "are frequently bad managers, even where they are not corrupt. They spend money on what is not really wanted; they spend more than they ought on what happens to be necessary; and they incur liabilities and burden the future with a light heart."

But the object of Sir Robert Giffen's contribution is not to discuss the threadbare subject of municipal trading; it is to consider whether the growth of local expenditure cripples very seriously the whole financial position of the country. In this connection, he says, there are two special evils which should receive attention. One is the excessive strain upon the real property which is the main source of the income of local authorities, and is also part of the source from which the imperial income-tax is derived; these charges (together with the death duties) being so high as to deprive the country of the financial reserve it ought always to possess in its real property specially, as well as in the incomes generally liable to income-tax. The second evil is the collection of revenue by imperial authorities on account of local bodies to the extent of £10,000,000 a year, made up largely of the kind of revenue which should be reserved for the State. The remedy advocated for the first-named trouble is a reconsideration of the system which has shifted the burden of taxation from direct to indirect taxes; but even Sir Robert hesitates to bring to a really logical conclusion what he says as to the second evil by urging the immediate appropriation by the imperial authorities of the revenues referred to. Though, however, he does stop short of this, the suggestions contained in the article (which is justly accorded first place in the pages of our contemporary) are, as will be gathered from these few remarks, of a sufficiently striking character.

THE LAW AS TO WORKMEN'S COMPENSATION.

South Metropolitan Accident Fund—The Jury System.

Reference was made last week to the fact that only two Gas Companies—the South Metropolitan and South Suburban—were so far included among the undertakings that have formulated mutual schemes for the provision of compensation in case of accidents to the men. Full information regarding the South Metropolitan Company's system was given in evidence by Sir George Livesey and Mr. Henry Austin (one of the Workmen Directors) before the Departmental Committee on the Law Relating to Compensation for Injuries to Workmen (whose report has already been noticed, p. 26), from which the following particulars have been gathered.

So long ago as 1842, the Company had a sick fund which provided for incapacity from all causes; and in 1893 definite regulations were adopted, giving the Engineer of each station authority to increase, at his discretion, in case of accident, the sick pay from 12s. to 18s. per week. In the same year, the "jury system" of inquiring into all accidents (which will be referred to again presently) was introduced. In 1897, the scheme was extended; and on the passing of the Workmen's Compensation Act in that year, it was submitted to, and duly certified by the Chief Registrar of Friendly Societies; the idea of the Directors of the Company being that, by instituting a mutual arrangement of this kind, they would enlist the active co-operation of the workmen in the prevention of accidents. The rules provide that sufferers from accident shall have compensation if it incapacitates for not less than three days. There is a sick visitor, by whom all the men are visited, so that the probability of malingering is reduced to a minimum; and the men themselves, being actively interested in the same object as the Company, have also assisted in preventing this abuse. Another object was to provide for the widows of men killed (the average of fatal accidents being a little more than one a year), by other means than a lump sum. The provision for men (with free medical attendance) is as follows: Minor or slight accidents, disabling for not less than three days nor more than a fortnight, 12s. a week. Serious accidents causing incapacity for more than a fortnight, 18s. a week. Accidents clearly caused by the negligence of the Company or their officers, 24s. a week. There is a further rule that any member of the fund whose injuries have been caused by his own "serious and wilful misconduct," whatever may be the period of disablement, shall receive nothing from the fund beyond the amount derived from his own contributions. To such men the Company give no undertaking as to future employment But work is found for others on recovery at not less than 24s. a week if the wages exceeded that amount; and for those injured by the negligence of the Company, at not less than four-fifths of the day wages previously received, and in no case less than 24s. a week if the wages exceeded that amount. To widows, a pension is granted so long as they lead a respectable life or until re-marriage, when a sum not exceeding £10 is paid to them. The pension is not less than 10s. a week; but during the first three years the Co-Partnership Committee may, according to

circumstances, grant any amount not exceeding £1 per week, which may be reduced gradually to the minimum of 10s. a week at the end of three years, or sooner or later.

The men pay 2d. per month to the fund, and the Company pay 4d., making 6d. per man per month. This has been found sufficient; but the Company guarantee the stability of the fund. Between 1898 and 1902, the percentage of accidents declined from 6·91 to 4·6. In 1903, it went up a trifle, to 4·84; but even this showed a reduction of nearly one-third when compared with the 1898 figure. The casual men have the option of subscribing to the fund or depending merely on the provisions of the Compensation Act; but they practically all do subscribe. Since 1899, the number of cases of over two weeks' duration has averaged 49 per cent. of the whole. The amount paid in 1903 by way of pensions in respect to fatal accidents in that and previous years was £548; whereas in 1898 it was only £311. This increase, however, has not been caused by a larger number of fatalities, but is merely the natural growth of the pensions from year to year. In addition to the £548 for fatal accidents, £398 was in 1903 paid for serious cases after the first two weeks, and £290 for the first two weeks—*i.e.*, for incapacity for a fortnight and under and the first two weeks of serious cases.

In 1892, the system was introduced by the Company of holding an inquiry into accidents by a jury of twelve workmen. This inquiry is held if possible within a fortnight of the occurrence, under the presidency of the Engineer of the station concerned, except in the case of fatal accidents, when the Chairman or one of the Directors presides, and the investigation is held subsequently to the Coroner's inquest. At the discretion of the Engineer an inquiry may be made on any accident that is not a charge on the fund, or that results in loss of, or damage to, property. The juries are chosen from men who have been in the service for three years or more; and the rules are so framed as to give all such men a chance of serving in turn. Witnesses are called, and the circumstances of the accident thoroughly gone into; and then the jury retire alone to agree on a verdict. Their duty is first of all to arrive at the real cause of the accident, and then to state whether blame attaches to any official or workman, or whether the plant, machinery, or means of protection were defective, if they are satisfied that there has been any neglect or carelessness, or defect. When necessary, the jury, in consultation with the President, have to decide in which class (for the purpose of compensation) the injured man is to be placed. This point, whenever there is any doubt, is decided by ballot, and by a two-thirds majority; only the twelve jurymen voting. The decision is, however, subject to a right of appeal, either by the injured workman or the Engineer of the station, to the Chairman of the Company, whose decision is final. If the jury are of opinion that anything can be done to prevent a similar accident in future, they have to make such recommendations as they think necessary. The inquiries take place in the presence of as many of the men as can conveniently attend; and where possible they are held on the spot where the accident happened. The following questions are submitted as a guide to the jury: (1) Was the accident caused by any neglect on the part of anyone connected with the Company; and, if so, who was in fault? (2) Was there any defect in the plant or materials used; and, if so, state what it was? (3) Was there any mistake in the manner in which the work was done; and, if so, state its nature? (4) Was the accident the result of any negligence or carelessness on the part of the injured man? (5) Was it a pure accident, for which no one was to blame? In the event of the jury finding that an accident was due to the fault of an injured man, this does not necessarily affect his compensation. He would get his payment just the same, unless it should appear to be a very gross case. There is no desire whatever to avoid paying compensation. If, however, a man has been careless, he naturally does not like to be brought up before a jury of his fellows to be questioned; and therefore the system tends to the exercise of increased care.

The average wages paid by the Company are about 32s. a week, or £84 a year; and, as already mentioned, the men subscribe 2s. a year to the fund and the Company 4s. a year per man, or a little more. This is sufficient to meet all charges for accidents under the rules and to provide pensions for the widows, which are now equal annually to rather more than lump-sum payments for two fatal accidents a year. Six shillings per man per annum on the average wages of £84 is equal to nearly 7s. 2d. per cent., of which low sum the Company pay only a little over 5s.; and as this is a figure at which in all probability no Insurance Company would look, Sir George Livesey argues that the Company's system must have proved a great preventive of accidents. While accepting all the obligations of the Act, the Company are giving more than the Act gives; and he would be very sorry if any legislation was undertaken which would interfere with the arrangement in force.

The accident fund is administered by the Co-Partnership Committee, who elect annually a Sub-Committee of twelve members selected from their own body—one workman and one official representing each of the Company's six stations. The Chairman of the Co-Partnership Committee is *ex-officio* a member; and in his absence the Sub-Committee elect their own Chairman. In the event of the Sub-Committee being unable to agree in any case, it has to be submitted to the Co-Partnership Committee. Notices of claims on the fund have to be sent in within three days after the occurrence of the accident; and in the case of further delay, the Sub-Committee have the option of dating the payment of the allowance from such time as they consider fair. Immediately a claim is formally made, the man must undergo examination by the surgeon appointed for the purpose. The allowance is, of course, conditional on the injured man doing nothing that may retard his recovery; and before any payment is made it must be proved that the accident occurred "while the workman was in the employ of, and actually engaged in, the work or business of the Company." When the Co-Partnership Committee consider that the interests of an injured man or of the fund will be thereby served, they have power to grant extras—such as a sum of money to enable him to go into the country.

GAS WORKS AND GAS SUPPLY OF LAUSANNE.

In the "Journal" some weeks ago we noticed briefly the proceedings at the annual meeting of the Swiss Association of Gas and Water Engineers, which was held at Lausanne on the 24th of September last. The papers read have since been published in the "Bulletin Technique de la Suisse Romande;" and as two of them related to the gas and water supply of the town, it may be of interest to give abstract translations of them, especially as, about this time last year, we published some particulars in regard to these services in the neighbouring city of Geneva. To-day we deal with the gas supply; leaving the other branch of the subject for a subsequent issue.

As in the case of Geneva, the supply of gas and water is in the hands of the Municipality, and it is grouped with electric lighting under the heading of "Industrial Services." This department of the Municipality was established in 1898; and its first act was to take over the supply of gas on the termination of the concession of the Lausanne Gas Light and Heat Company. The department then, in 1900, acquired the water supply; and they finally established the electric service by impounding the Rhone at St. Maurice, and distributing the water at Lausanne and in the communes for the production of motive power. Though the three services are combined in a central office, they are independent of each other, and are each supervised by a special official. They are all in active operation; and the financial results already achieved augur well for their continued prosperity in the future. At the close of the year 1903, they represented an invested capital of 17,108,000 frs. (£684,320), apportioned thus: Gas, 1,878,000 frs.; water, 6,330,000 frs.; electricity, 8,900,000 frs. The Chief Engineer is M. Louis Chavannes, who was the author of the paper we are now noticing.

The town of Lausanne, which, as some of our readers may be aware, occupies an elevated position above Ouchy, about the centre, on the north side, of the Lake of Geneva, was lighted for the first time by gas on Dec. 31, 1846. Previously the streets had been dependent for their light upon a few oil-lamps hooked to ropes stretched across from one side to the other. On Jan. 1, 1847, the Municipality entered into a contract for 24 years—viz., to Dec. 31, 1870—with M. Frédéric Loba, a chemist and a native of Rolle, for a supply of gas; and he put up small experimental works at Riponne. The prices agreed upon were 4c. per burner per hour for the public lamps, and 6c. for houses. If supplied by meter, the price was 34c. per cubic metre for the former, and 50c. per cubic metre for the latter purpose, or at the rates of 7s. 8d. and 11s. 4d. per 1000 cubic feet respectively. There was no stipulation as to the exact illuminating power of the gas, except that it was to be "as good as that of the gas made in Geneva." Many of the first consumers took their supply by the hour; and the present Manager of the works (M. Rochat-Reisser) who witnessed the change from oil to gas lighting, remembers the time when the lamplighter, provided with a key, went his rounds at nightfall, and, after knocking at the house door to announce his arrival, turned on the tap outside—repeating his visit at 11 p.m. and reversing the operation.

The results obtained at the Riponne works being regarded as conclusive, the Company which had been formed constructed others of more ample dimensions at Ouchy, on the lake side, in 1848, on the site of the existing works. They contained two settings of iron retorts, five in a bed; and there were two gasholders, each having a capacity of rather more than 12,500 cubic feet. The life of the retorts varied from 14 days to a maximum of six weeks. Local (Vaud) coal only was employed—*i.e.*, Belmont lignite, which contained a great deal of sulphur, from which the gas could not be completely freed by lime purification—a very expensive process. This defect was highly detrimental to the success of the Ouchy works, as the consumption of gas began to fall off in consequence of it, and the existence of the new industry was endangered. The position was, however, saved by the construction of the Lyons-Geneva Railway, after which (in 1856) it became possible to employ Loire coal, which was brought in trucks as far as Seyssel, then conveyed in carts to Geneva, and transported by boat to Ouchy. With confidence restored, the Company was re-constituted, the works were gradually improved, and a fresh start was made under more favourable conditions, and apparently under a renewed concession. A contributory incident was the extension of the railway to Lausanne, whereby good St. Etienne coal could be brought close to the works. The consumption of

gas now began to increase, until in the year 1895—the last year of the new concession—it reached 1,774,020 cubic metres, or rather more than 62½ million cubic feet. The termination of the Company's concession was the Municipality's opportunity; and on Jan. 1, 1896, they took over the gas-works and continued the supply. So successful was their management, that in their first year the production of gas was more than doubled—viz., 3,813,600 cubic metres, or about 135 million cubic feet. Without any interruption in the manufacturing operations, the works were gradually enlarged on the site of those of 1848; so that it was not possible to introduce modern machinery, owing to the inadequate space. It has been recognized by the municipal authorities that the works will have eventually to be removed; and already a plot of land, situated between Lausanne and Renens, has been purchased. This was a matter attended with some difficulty, as, Lausanne being located considerably above the lake, it was not easy to find a site which could be brought into direct communication with the Swiss Federal Railways, and thus permit of the conveyance of raw material into the works.

At present, about 75 per cent. of the annual supply of coal is obtained from the French basins of the Loire and Blanzy, and the rest from Germany (Saar coal). The trucks, on arriving at the railway station, which is situated about midway between Lausanne and the lake, are hauled up to Flon on one of the funicular lines of the Lausanne-Ouchy Company, and are thence lowered by another to the lake side. They are then drawn by electric traction to a point opposite the gas-works, and raised by hydraulic power into the yard, where they are unloaded. The coal is carried to the retorts in Decauville trucks which pass over a weigh-bridge. There are sixteen settings of horizontal retorts, eight in a bed, on the Lachomette system, with generators. They are charged by Eitle machines, which have been in operation for about a year with good results. A small electric motor of 1-horse power is employed to raise the scoop, which was found to be work too fatiguing for the men. A fan, driven by another electric motor of similar power, mounted on a special carriage, facilitates the scurfing of the retorts, which is now done with the loss of only one charge, instead of, as previously, occupying 24 hours. Owing to the use of French coal, six-hour charges are the rule. On leaving the hydraulic main, the gas passes into the foul main—a sheet-iron pipe about 30 inches in diameter and 110 feet long, fixed to the inner wall of the retort-house. The gas is divided into two streams, each of which goes through a set of Drory condensers and a scrubber. The two streams then unite and pass through a "Standard" rotary washer-scrubber, and are afterwards again divided before entering the purifiers. Of these there are two sets, each comprising three boxes in series. There are two exhausters, one of which is kept as a stand-by. On leaving the station meter, the gas is enriched with benzol vapour, and finally passes into the holders. Of these there are three, of 35,000, 85,000, and 140,000 cubic feet capacity respectively; giving a total storage of 260,000 cubic feet. This is found to be adequate, with careful attention, though the maximum daily consumption is about 565,000 cubic feet. It will thus be seen that the holder capacity is only about 46 per cent. of the greatest demand; but it has to suffice, as it is not considered advisable to erect a new holder on the present site. Besides, the maximum daily consumption of gas tends to decrease, notwithstanding the augmented annual sales resulting from the more general use of gas for cooking purposes, chiefly during the summer.

A few particulars may be given here in regard to the action of the "Standard" washer-scrubber already alluded to. It consists of two chambers containing anthracene oil, and six for the removal of ammonia by means of washing with clear water. It was first brought into use on Sept. 11, 1903; and up to the time of the preparation of the paper, it had used about 10 lbs. of anthracene oil for 35,300 cubic feet of gas; but it was hoped to reduce this quantity by the employment of oil of better quality, and utilizing its absorptive power to the utmost. With reference to the effect of the apparatus in preventing naphthalene obstructions, it was found that after being in use for six months there were no deposits in the gasholder inlet and outlet pipes, which had previously to be cleared twice a year. This result was so favourable as to encourage M. Chavannes to go on; and he hopes that in a year or two the town mains will be quite free from naphthalene obstructions, if the attempt to clear away existing deposits is continued energetically. As a general rule, the mains are not blocked; the deposits taking place mostly in the consumers' service-pipes and in the taps. During the winter of 1903-4, the number of stopped pipes was less than usual; but, unfortunately, this was not the case after the hot summer had set in. With the return of cool weather, however, the inconvenience ceased. M. Chavannes considers that the best course to pursue is to free the gas as much as possible at the works by means of the anthracene oil washer, and guard against deposits in the mains by fumigating or washing them with suitable solvents. In fact, he has already adopted this course; and he hopes within two years to be entirely free from naphthalene troubles. He will be pleased to receive advice from any professional colleagues on this subject, which, as he pointed out at the meeting, is one in which gas managers everywhere are more or less interested, as shown by the number of washers installed of late years, and the articles and discussions which have appeared in the Technical Press. He is doubtless awaiting with curiosity the result of the labours of the Committee of the Southern Association.

To proceed with the description of the Ouchy works, it may be mentioned that they possess an Eitle coke-breaker, operated by a 5-horse power electric motor; an electric winch of similar power for traction purposes, and for loading railway waggons on lines with a rising gradient of 2 in 100; and a tar-pump driven by a 2-horse power electric motor. The ammoniacal liquor is concentrated in a Feldmann apparatus capable of dealing with 2250 gallons of weak liquor per 24 hours. A building situated to the north of the works, partially below ground, and forming a water-tight tank, contains the benzol reservoir and all combustible liquids. The tank of the 140,000 cubic feet holder is of armoured concrete. It was erected in 1897, and it has not since given any trouble, though the larger portion of it is below ground, and is merely surrounded by an earthwork embankment.

The distributing mains are 65,845 metres (72,430 yards) in length. The only peculiarity about them is that they are arranged in tiers, owing to the situation of the town, the lower part of which stands at an elevation of nearly 1000 feet, and the upper part at 2000 feet, above the sea. This great difference in the levels necessitates the division of the towns into zones, each having a separate governor. The lower zone, supplied by two mains, is controlled by the two governors at the Ouchy works. They reduce the pressure at the gasholders, which is about 40-10ths, to from 18-10ths to 32-10ths, according to the time of day and the season. A small special zone, comprising Ouchy only, is supplied from the holders direct, without governors. The pressure in the middle zone, which comprises the greater part of Lausanne, is controlled by two governors fixed at the entrance of the old town on the two mains which have already served the lower zone. The pressure above these governors, ranging from 36-10ths to 52-10ths, is reduced to 28-10ths and 36-10ths according to the time of day and the season. Lastly, three new zones have been recently formed, called the upper zones, by fixing district governors on the mains serving the higher portions of the town. They are by Giroud, of Paris, and they lower the pressure in accordance with requirements. They are located in small chambers under the roadway, and are automatically operated by clockwork, so that the pressure changes from the time of lighting till the time of extinction at 11 p.m. This division of the town into zones, coupled with the reduction of excessive pressure and a systematic search for leakages, gradually brought down the unaccounted-for gas to 4·63 per cent. in 1903—a figure M. Chavannes thinks it scarcely possible to reduce further, owing to the peculiar configuration of the town.

In conclusion, M. Chavannes remarked that during the past three years there had been only a slight increase in the quantity of gas sold, owing to the competition of electricity. But he thought that by the adoption of additional facilities for the installation of rising mains in the houses and the extension of the town, the consumption would rapidly increase in the near future, especially as gas is becoming more highly appreciated for culinary purposes in large as well as in small households.

COAL MINING AND THE COAL TRADE.

About six years ago, there was published by the "Colliery Guardian" Company, Limited, a volume bearing the title of "Annals of Coal Mining and the Coal Trade, the Invention of the Steam-Engine, and the Origin of the Railway." The author was Mr. Robert L. Galloway, M.Inst.M.E., a mining engineer and a certificated colliery manager. In that work, the author traced the history of the use of coal from the earliest times down to the year 1835. He began by showing that this material, so valuable to the gas maker, was employed to a small extent by smiths in Greece and Italy in the time of Alexander the Great, or about 350 B.C. He then passed on to consider the question of whether the mineral was likely to have been used as fuel in Britain in the Stone Age, and cited instances of coal ornaments having been found amid surroundings of great antiquity and in the company of flint implements. He alluded to the discovery by archæologists, in modern times, of coal and its ashes in many Roman stations in different parts of the kingdom, particularly on the line of the Great Wall from the Tyne to the Solway Firth—indicating that some use was made of coal in the period of this ancient civilization. It was pointed out that there is an absence of authentic records relating to any use being made of coal in Britain in the Dark Ages; a passage in the Anglo-Saxon Chronicle generally supposed to refer to coal being shown to mean more probably peat. The actual records relating to the working and use of coal (indicating the commencement of the great modern coal trade) begin about A.D. 1200, when the mineral first obtained a distinct name of its own, and was called seacoal in contradistinction to charcoal, to which the simple name of "coal" originally belonged; and the records relating to the working of coal in the various coalfields, so far as they are available, were traced by Mr. Galloway down through succeeding centuries. He showed that in the Middle Ages coal was chiefly used by smiths and lime burners, and only to a limited extent for household purposes.

It was quickly realized that coal could not be burnt without the production of smoke; and the larger the bulk of material used, the greater would necessarily be the discharge of this impurity into the atmosphere. Consequently, as early as 1307—about the time when Edward the Second came to the Throne—there

were complaints, as now, of the "smoke nuisance;" and a Royal Commission was appointed to suppress the burning of coal in London, except by smiths. Reference to this subject led the author to allude to the difficulties in the way of substituting coal for wood in house fires, owing to the fireplace being in the centre of the floor, and there being no chimneys in early times. Strong dislike was entertained to the new fuel, until its use became an absolute necessity owing to the failure of the supply of wood; but the rapid increase in its employment in the reign of Queen Elizabeth was accompanied by a great building of chimneys, which was animadverted upon by contemporary writers. The difficulties experienced in substituting coal for wood and charcoal in the arts and manufactures, and the application of the charring or coking process to coal, were next described.

From this subject the author proceeded to deal in detail with the introduction of railways and the invention of the steam-engine, not only as being two of the chief mining improvements, but as having subsequently attained to such world-wide public importance. The troubles of the miners with noxious gases were described, and an account was given of the innumerable explosions of fire-damp, leading to the contrivance of the machine known as the steel mill, and later to the invention of the Davy lamp; while other improvements and innovations, relating to the ventilation of the mines, the use of gunpowder, &c., received proper notice. The introduction of lighting by gas, the general adoption of steam power, the establishment of steam locomotion and navigation, were also included; and this brought the narrative down to the time of the Select Committee of the House of Commons on Accidents in Mines in 1835.

In a second volume which has lately been published,* the story is continued to the passing of the Coal Mines Inspection Act in 1850. The author starts by showing how the increased activity in the coal and iron industries brought about by steam navigation and the Railway Mania led to the opening of new collieries in the North of England. The result was a rapid development of the Wear and South Durham district, and the formation of great joint-stock coal companies. Some notable new collieries were opened in other coalfields, and the steam coal trade of South Wales came into existence. A sinking was also made with the view of obtaining coal at Northampton. A great deal of the next portion of the book is devoted to a record of the outbursts of fire-damp at various collieries. It was not unnaturally supposed that this destructive gas might be utilized; and in the summer of 1840, a company was formed to supply Newcastle, Gateshead, North and South Shields, Sunderland, and Bishopwearmouth with natural gas from Wallsend. By the end of November, pipes had been laid to Carville Station on the Newcastle and North Shields Railway, and several lamps were lighted in the evening. But the illuminating power of the gas was so low that the experiment proved a failure, and so the enterprise was abandoned. After the lapse of half a century, a similar proposal was started, as our readers will remember, at Heathfield; but it has not been attended with very marked success. The author devotes several chapters to the subject of explosions, and in one gives an account of some serious accidents to coal-laden ships through the firing of the gas evolved. A curious story is told of fire-damp making its way into a house at Wigan, and causing an explosion in a cupboard.

We must pass over the intervening chapters on this subject, and come to those dealing with the two methods of mining coal—the pillar system and long work. These lead to others on the various appliances for ensuring the ventilation of mines. Notwithstanding all efforts to secure purity of the atmosphere of the workings as far as possible, some further protection of the operatives from danger was required, and it was thought to have been furnished by the Davy safety lamp. Yet this was vehemently denounced as being the cause of more accidents than would have occurred had it not been invented; and in a memorial presented to the late Queen in the early years of her reign, it was characterized as an "*ignis fatuus* that lures to destruction." However, the lamp is still with us, and doing good work. The author passes next to deal with the different methods of raising coal from the pit, and the screening of it when it is brought to the surface. There it is divided into three sorts—round, nuts, and "duff;" the two latter kinds being each about 12 per cent. of the total. The author alludes to the various attempts that have been made to coke the small coal; and this naturally leads him to take up the subject of coke-ovens and their residual products. It may come as a surprise to many to learn from Mr. Galloway's book that several ovens were in use at the Duke of Norfolk's collieries at Sheffield in 1802 for "coking the refuse coal previously entirely useless." The author next passes in review the various processes for employing coal dust by mixing it with tar for the production of patent fuel, and then deals with the utilization of the bye-products of coke-ovens. A sketch of the history of the mineral oil industry in Scotland, with which the name of Young is so intimately associated, forms the subject of an interesting paragraph. The final chapters deal with the inquiries into the circumstances connected with the explosions at the Darley Main and Lletty Shenklin Collieries in 1849, the intervention of Parliament, and the passing of the Coal Mines Inspection Act. The two volumes present an exhaustive review of the progress of the mining industry.

* "Annals of Coal Mining and the Coal Trade." By Robert L. Galloway, M.Inst.M.E. Second Series, with Illustrations. London: The "Colliery Guardian" Company, Limited; 1904.

PERSONAL.

At the meeting of the Macclesfield Town Council last Wednesday, the appointment of Mr. W. Newbigging as Gas Engineer to the Corporation in succession to his late brother, provisionally made by the Gas Committee a few weeks ago, was confirmed. Mr. Newbigging will be allowed to have consulting clients, so long as the management of the gas-works is not interfered with.

Mr. David C. Clark, Works Assistant to Mr. J. G. Tooms at Waterford, has been appointed Assistant-Manager and Draughtsman to the Monte Video Gas Company, and leaves next month to take up his duties. Mr. Clark was trained in the firm of Messrs. Balfour, of Leven, Fife, served with the Stirling Boiler Company and Messrs. Redpath, Brown, and Co., Constructional Engineers, before going to Waterford some six or eight months ago.

OBITUARY.

CHARLES HORSLEY.

We regret to record the death, on the 4th inst., at his residence in Highbury New Park, at the age of 75, of Mr. Charles Horsley, who was well known to many of our readers from his connection with several important gas and water undertakings. He joined the Board of the Harrow Gas Company at the time the works were purchased by Mr. John Chapman, the father of the present Engineer and Secretary, in June, 1872; and he was appointed Chairman on the retirement of Mr. James Glaisher about four years ago. During his directorate, in 1895, the Stanmore Gas Company was absorbed by the Harrow Company, and the latter took the title of the Harrow and Stanmore Gas Company. Mr. Horsley was the last remaining Director of the original Board. There were four others, who have all passed away. He was also Chairman of the Dartford, Hemel Hempstead, and Tuscan Gas Companies, of the Barnet Gas and Water Company, and the St. Albans and Woking Water Companies; and, until the purchase of the undertaking by the Water Board, he was a Director of the Grand Junction Water Company, and a member of the Joint Committee of the London Water Companies. He was an original Director of the Barnet Company, and was the last survivor of the original Board. A friend who knew him well says: "He was a wise administrator in keeping the dividends of the different Companies at a point that should not strain the financial position. In both the Tuscan and Barnet Companies these were considerably reduced under his chairmanship." Mr. Horsley was a member of the Institution of Civil Engineers; having been elected an associate member in May, 1878, and transferred to the members' list in 1883. He was also a member of the Society of Engineers, of which he was President in 1881. As many of our readers are aware, he carried on the business of Messrs. James Oakes and Co., at Wharf Road, City Road. He was for years an active member of the magisterial bench in Middlesex, and more recently of the London County bench. He was returned, with Mr. Torrance, unopposed, at the first election of the London County Council, as one of the representatives of East Islington, but did not afterwards seek re-election." The funeral took place last Saturday, and was attended by many friends of the deceased. The first portion of the service was gone through at St. Augustine's, Highbury New Park, and the remainder at St. Marylebone Cemetery, East Finchley, where the body was interred.

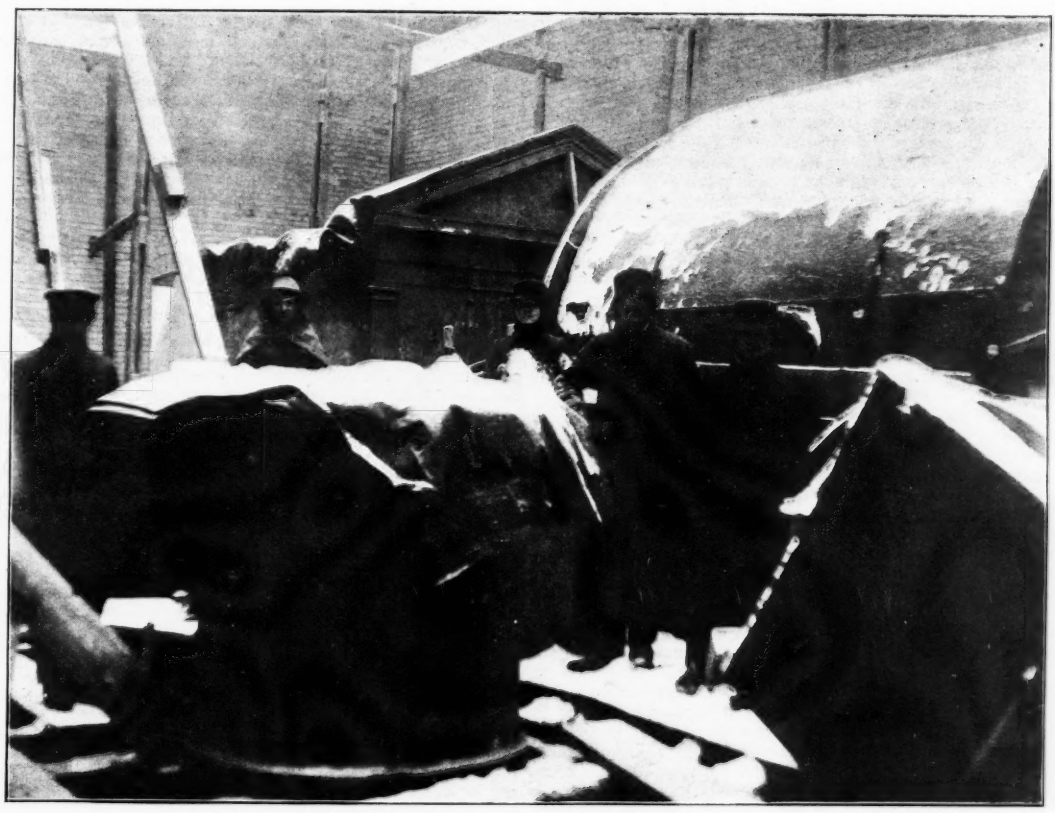
A large number of our readers north of the Tweed will learn with regret of the death, on the 23rd ult., at the early age of 49, of Mr. John Wilson, formerly Manager of the Tradeston Gas-Works of the Glasgow Corporation. He had been for some time in indifferent health—his mental faculties having given way. The respect in which he was held was testified by the attendance at his funeral of many members of the Corporation, as well as by about twenty of his former colleagues.

Many of our readers will learn with regret of the death, on Tuesday evening last, after a somewhat lingering illness, of Mr. Charles Pattrick, who had been connected with the firm of Messrs. W. Parkinson and Co. and their successors for a period of more than 35 years, and was well known in the gas industry. He leaves a very wide circle of friends, by whom he was greatly respected; and his loss will be keenly felt. The interment took place on Saturday, at Brompton Cemetery.

We are sorry to learn that the pleasant associations of Christmas and the New Year were marred for Mr. E. D. Sapey, the Manager and Secretary of the Horsham Gas Company, and his family, by the death of his eldest son, Mr. Louis V. Sapey, which took place last Tuesday at Amsterdam. The deceased, who nearly 21 years of age, was much esteemed, and gave promise of a bright career. Educated at the Horsham Grammar School, he was articled to Messrs. S. Cutler and Sons, and at the end of his time superintended the erection of the large granaries at Millwall for the Millwall Dock Company, then new works at Harwich for the Gas Company, and finally went to Amsterdam to superintend works there for Messrs. Cutler. Deep sympathy is felt for Mr. and Mrs. Sapey and the family in their great bereavement. The body was brought to England; and the interment took place yesterday.

COLD WORK AT WINNIPEG.

HERE we have an interesting photograph which will convey to our readers some of the difficulties attending constructional work in the far west. For this contribution, we have to thank Mr. D. Macfie, of Messrs. James Milne and Son, Limited, who are at present engaged in erecting a station meter and governors at Winnipeg. The difficulties of prosecuting structural work in this country during the winter are sufficiently great; but compared with such a clime as that in which this work is proceeding, the conditions here are comfortable. Just think of this: When the photograph was taken the thermometer was 25° below zero; and the difficulties of handling cast iron under such circumstances, of course, are very severe. The men must work all the time with mittens on, as to touch cast iron with the bare hand would simply result in the skin being left behind. However, the men in the photograph do not by any means look dissatisfied with their lot, notwithstanding the discomfort to which they must be exposed. The photograph was sent over by Messrs. Milne's foreman in charge of the work.



THE LIGHTING OF BERLIN.

By "A."

The term—half reproachful, half complimentary—of "modern Babylon" is often used when speaking of London with its vast indefinite charm, its never-ending stream of joy and sorrow. But if one gives to the word "Babylon" the significance it generally conveys, then I think it should be applied to Berlin, for in no other city of my acquaintance do materialism and modernity possess such an absolute sway. Berlin, which is, comparatively speaking, of mushroom growth, appears to me to have progressed out of all knowledge during the few years which have elapsed since I was last there. Then the electric car system was in its infancy, and there was no Sieges Allée—for all the world like an animated mausoleum; while it is now an orgie of noise, life, and light.

In order to appreciate any description, however meagre, of the lighting of the city, one must understand that the principal streets (barring the Unter den Linden) are comparatively narrow, are mostly of modern origin, are traversed by a constant stream of trolley electric cars, and are flanked by buildings whose fronts are for the most part stone, which (oh! blessed Berlin air!) keeps clean and white. There is not observable the slightest attempt at architectural beauty or uniformity, but only a vast striving after the very latest effect in sensational architecture—in fact, the personification of *l'art nouveau*. It will readily be understood that in a city where the "latest" effect is a desideratum, there must be the additional attraction of light, light, light; and so one gets a bewildering confusion of large arc lamps, flaming calcium lamps, intensified incandescent lamps, clusters of Nernst lamps, myriads of glow lamps, row upon row of Welsbach burners, and, to crown all, multitudes of disappearing street signs of various colours, sizes, and devices. These advertising signs are perhaps the most irritating thing in Berlin. They range from the one-word-at-a-time variety to the Fregoli-esque quick colour-change effects, and include (most worrying of all) the electric signs whose light flashes quickly across them, for all the world like a series of gas-jets being blown out by fitful gusts of wind, and as quickly relighted.

These lights are, of course, the private contribution to Berlin's lighting; and what will one say when, down the centre of a street, perhaps as wide as the Strand at Charing Cross, and containing the conglomeration above depicted, there are suspended good 1000-candle power arc lamps, only 36 yards apart—not sleepy, wheezy, flickering arcs, but steady, unblushing globes of solid light? The effect is amazing; the cost must be prodigious. I am quite sure that in all the principal streets there are four to six times the volume and number of public lights that we find in our best-lighted London streets—Lucas lamps, intensified lamps, and clusters of burners being freely employed—and yet I am bound to say I found the effect singularly garish. For instance, in a comparatively narrow street like the portion of Friedrichstrasse running from Leipzigerstrasse to the Linden, one finds powerful Lucas lamps placed *vis-à-vis*, and only about 33 yards apart, not set on columns, but suspended like electric arcs. The result is brilliant; but either Berlin lighting must be very economical or else Berlin ratepayers must have good tempers and large pockets. The lighting of the Unter den Linden, which is a magnificent, broad, leafy avenue, is splendid, however; the volume of light seeming more in keeping with the fine proportions of the street itself, and flooding the dullest night with a light which is only second to the "moon's celestial highness."

With regard to private installations, the same lavish hand is apparent. The neighbour of a shopkeeper who uses four or five large "blue" arcs in lighting his front, will endeavour to "take a rise" out of his competitor by displaying his wares by means of a row of flaming arcs, each of at least 2000-candle power, and put as close together as possible. The inside of a display shop window simply bristles with fantastic lights of all descriptions—lights growing from bouquets, lights illuminating a "maiden's prayer," lights hanging, lights leaning, sober lights, merry lights, lights static, lights moving. One notices, too, a great many

examples of shop lighting on the concealed top-light system, and very effective it is. But, alas! in many cases it is spoilt by the inevitable row of arc lights outside the window.

Even the stage has caught the craze for light; for the title of a ballet in a popular piece which is applauded nightly is "Das Licht," and instead of the usual rows of Dresden shepherdesses, Trouville bathers, and other Arcadian beings, the twinkling forms of glow lamps jostle with shapely representatives of arc lamps, who in their turn are followed by rows of moving incandescent burners, while the good fairy of light looks down approvingly when the curtain rings down on a *finale* in which hundreds of revolving lights and an infinity of ingenious lighting devices figure in picturesque and multi-coloured confusion.

Of the numerous designs of gas-burners (flat flames are as dead as Queen Anne), many are meretricious; but there are certainly to be seen some very neat and artistic pendants and brackets for both vertical and inverted mantle burners, the design and conception of which are a welcome relief to the eye, while the finish is worthy of a nation which excels in detail. There is in many cases, of course, a tendency towards the twisted and tangled curves which in German eyes seem to constitute Art; but generally speaking, the design and arrangement of the gas-lights leave nothing to be desired. A salient feature is the spread of inverted burners of all descriptions, while the osmium lamp is also well to the fore, and there are to be seen many novel and well thought-out schemes of lighting. For example, the restaurant and drawing-rooms of one of the best Berlin hotels are rooms of very chaste design, with lightly decorated wall and ceiling panels framed with gold. The lighting consists of ordinary electric arc lamps hung from the centre of the ceiling panels, covered with rather thick globes, and merely decorated with crystal lustres. The result is a wonderfully pleasing soft, shadowless light, and not the eyesore that one would imagine from the description of such an apparent incongruity—for an arc lamp in a drawing-room sounds like a bull in a china shop!

To conclude these stray remarks with a few serious words. In the first place, it is difficult to pronounce as to the relative popularity of gas and electric light; but for public purposes there are certainly more gas than electric lamps, while for private lighting the incandescent mantle appears to hold its own. That Berlin is splendidly lighted there is no doubt; but it must not be forgotten that the bright colour of the buildings and the shop-lights render it very difficult to judge of the real efficiency of the street lighting proper, especially when so many of the shops and the *cafés* are lighted throughout the night. Those interested in the subject are referred to the careful work of Professor Drehschmidt, a report of one of whose communications appeared in the "JOURNAL" for Dec. 8, 1903, pp. 616, 617. It must be remembered, looking at these figures, that they are expressed in Hefner-metres and not foot-candles. It is very evident that a vast amount of money must be spent annually; but it is also a palpable fact that, not only in the streets, but in private establishments, very much more interest is taken in maintenance. The result is that in respect of efficient carbons, clean globes, new mantles, and clean burners and lanterns, the maintenance is all that can be desired; and if we are to draw a lesson, it is that, not only is it necessary to provide and encourage the use of the very best lighting apparatus, but also to see that it is employed properly and kept in good condition.

THE TESTING OF INCANDESCENT BURNERS AND MANTLES.

By H. LEICESTER GREVILLE, F.I.C., F.C.S.

The last word on this important question has yet to be said; and I have no ambition to pose as the final expert. The latest communication on the subject appears in the "JOURNAL" of Dec. 13, from Mr. Victor A. Rettich. I read this with very great interest. Mr. Rettich's record of his tests with a cheap German mantle, as to durability, is a striking example of what was previously suspected, if not absolutely known, as to the practical value of cheap mantles, and is a forcible example of the necessity of a durability test. Mr. Rettich has given us a good idea of a possible standard burner for testing mantles. This is a distinct advance on the general question. The proposed burner has the advantage of: (*a*) Regulation of air supply; (*b*) the mantle being removable without breakage.

With regard to the first point, it is obvious that any burner claiming to consume all grades of gas to the best advantage must have an adjustable air supply. The second point is also a distinct, although a minor, advantage. Then the suggestion of a standard mantle is that, under a process such as the "Buhlmann," there would be a strong and reasonable presumption that mantles could be prepared of a uniform character, and therefore reliable under specified conditions of definite photometrical results. We have therefore the suggestion of a standard burner and a presumably uniform mantle—uniform in the sense of light efficiency and durability.

How does all this help us to a definite conclusion as to any method of fixing up a combination of burner and mantle which can be taken as a "standard?" A standard in this case would mean a certain defined prescription by which others differing may be judged. Let us assume that a standard burner with an adjustable air supply would meet the question of gases of different composition and needing varying quantities of oxygen to develop their maximum heating value, and that we can rely on a definite mantle, we have still to face the difficulty of different-sized burners and mantles. How, if we take Mr. Rettich's standard burner with its fixed dimensions, are we to express the value of burners and mantles of a different calibre? How would it be possible to give a "standard" value to combinations of mantles and burners ranging from 20 to 500 candle power; from the "Gem" inverted incandescent to the large installations used in open-air lighting?

Further, although even a standard and adjustable burner may be available, no manufacturer of burners would accept it as *the* best. There are no end of patents and claims in the market which profess, by some special modification in construction, to effect better results on the burner itself from many causes, but mainly through a more perfect admixture of gas and air. I have known makers go, in this direction, to the extent of claiming that an equal result could be secured by the use of their special devices with gas at the ordinary pressure as could be obtained by the high-pressure system, involving the use of expensive machinery. Finally, we have the broad question to consider, Would the adoption of a standard burner and a standard mantle have any practical value under the varying conditions of commercial enterprise? I think the answer must be in the negative. I can hypothecate an ideal expression of scientific opinion, but science must have an absolute basis; and in the case under consideration this appears to me to be impossible.

Given a standard burner, a reliable mantle, and an adjustment of the air supply to secure the maximum efficiency of light, we might procure an ideal standard and express the figure by a unit (say, 100). Another mantle to be tested, placed on the same burner, would give a figure higher or lower as the case may be (for the world is full of possibilities). The light capacity of the mantle would then be expressed in reference to the standard at any figure below or above the standard. With regard to durability, the unit might be an average of a defined number of hours burning with a mean light at the start and the finish. This might be also called 100, and other mantles subjected to a similar test reported upon as so much under or below the unit. If we had a prescribed burner and mantle, this hypothetical arrangement might be of some value; but we have so many varying conditions that the idea is impracticable. At the same time, I give Mr. Rettich my best wishes that he may secure a solution of a vexed problem.

TWO YEARS' WORK FOR A SMALL BOROUGH GAS DEPARTMENT.

By T. EBENEZER PYE.

Apart from the quaint picturesqueness and historical associations of the very ancient borough and Cinque Port of Sandwich, one's first impressions, more particularly in relation to practical business, date back to an interview in the private office of the genial Town Clerk of the Borough—a gentleman who, in his skilful handling of heated and recalcitrant councillors, need certainly take no second place to his worthy prototype of Ephesian fame. Here it was that I first learned of the actual position of the Sandwich Corporation gas undertaking in the autumn of 1902, when I took charge. Summed up, it was as described below.

Capital Account.—This was just about to be closed. When fully made up, it would represent an annual charge on the concern (in interest and repayments of loans) amounting to about 1s. 9d. per 1000 cubic feet of gas sold. Roughly, the aggregate amount was about 21s. 6d. per 1000 cubic feet of gas sold—a somewhat formidable burden for a progressive manufacturing or commercial town of medium size, but certainly not insurmountable. Unfortunately, however, Sandwich boasts of none of these qualifications, being purely agricultural and not progressive.

Debit Balance at the Bank.—In addition to the incubus just named, there was, owing to an annual deficit arising from the workings of the department, a bank overdraft—"balance due on revenue account"—of about £1800. This overdraft was, by arrangement made from time to time, increasing year by year according to the deficit referred to. To this matter—in the opinion of the writer, the most dangerous and unsatisfactory of all—reference will be found in the tables below.

Revenue Account.—The revenue account of the financial year closing a few months previously had disclosed a *debit balance* carried to the profit and loss account of £240 18s. 2d., which amount, added to the sums then payable (and now increased) in interest and repayment of loans of £716 9s. 9d., brought up the total loss on the year's working, irrespective of capital expenditure, to £957 7s. 11d.

Gas Consumption.—This was rapidly on the decline. For several months after my advent, the returns continued to show a *decrease* varying from 5 to 8 per cent. on the previous year's consumption, due chiefly, I think, to consumers actually giving up gas. The

Gas Department was admittedly intensely unpopular. On one point, however, the townspeople and authorities were absolutely of one mind—viz., that *any increase of consumption*, if it could be obtained, *must come from outside the town*, as Sandwich was already taking all that was possible. Considering that the Council have no statutory powers to supply gas outside the borough, the meaning of this consensus of opinion was, of course, obvious.

Buildings and Plant, Coal, &c.—Here the report was more encouraging. A new retort-house, with new beds of retorts (direct fired) had just been put in under the competent direction of the Council's Consulting Engineer. Regenerative settings had been put forward, but declined on the score of higher initial cost. Londonderry coals had been in use for years, but with an average yield, apparently, of certainly not more than 9000 cubic feet per ton. The distributing plant was fairly equal to requirements; but, as already stated, no further capital was available for needed extensions or enlargements. The public lamps were all of the old-fashioned types, mostly fixed upon cradle brackets in deplorable disrepair.

Workmen.—The report on this subject is perhaps best dismissed with the Committee's earnest recommendation to forthwith "Sack the jolly lot." As a staff, they certainly had, throughout the Corporation ownership of the concern, been a bye-word in the town and a despair to the management.

Such, then, is an accurate digest of the state of affairs, as submitted to me by the Town Clerk *before* my final appointment, and as very quickly verified by me when I found myself in office.

How the Work was Tackled.

My first consideration was—I think rightly—the works. In spite of the report of the Committee and of the previous Manager, I retained the whole of the workmen for some weeks, with a view to a full opportunity being given for both sides to take mutual observations one of the other—for the men to ascertain what my methods and attitude towards them might be, and for me to find out what latent possibilities there might be in them if led as I was prepared to lead them. As a result, one man was discharged within three months, after having more than one warning, and another soon followed. Then for months after no further changes arose; nor would they have arisen but for one of the remaining hands committing a serious misdemeanour which had nothing in common with the troubles of earlier days. For the past eighteen months there is no record of misdemeanour or serious failure of duty of any one man of the staff, nor have there been any changes in the staff. In the retort-house, changes were introduced in the charging, to bring about a more uniform passage of gas through the plant throughout the 24 hours. A suspended scoop was then introduced, and the yield of gas was very soon raised to over 10,000 cubic feet of 17-candle gas per ton of coal.

In the Committee Room.—But no amount of improvement in works results would suffice to put the concern on a self-supporting basis. Upon the most careful computations—assuming a yield of gas of 10,500 cubic feet and a higher sale of coke per ton, I found that it would be necessary to increase the sale of gas by 40 per cent. before the net cost could be reduced to 2s. 6d. per 1000 cubic feet of gas sold—the figure to which, in view of the high charges in interest and repayments of loan, it was necessary to get in order to make both ends meet. I therefore urged on the Committee that the only salvation of the concern could possibly lie in *increased consumption*. This, as already stated, was looked upon as a complete impossibility. Eventually, however, the Committee gave way, and a comprehensive exhibition was held, with practical demonstrations with every conceivable type of gas-utilizing apparatus for domestic use, and numerous lectures by myself and my wife.

The Exhibition and its Results.—As regards attendance, the exhibition was a huge success. But the after-results came as a revelation to my Committee. Arranged for as a forlorn hope, it had not entered into their calculations that the applications directly resulting from it for new supplies would aggregate to a number equalling from 15 to 20 per cent. of their present roll of consumers. But such was the case; and the applications have continued to come in, and are now quite equal to over 25 per cent. of the number I originally found on the books.

Its Difficulties.—But we were face to face with a serious difficulty. We had no capital account open from which we could draw to pay for putting in these new supplies; and the revenue account alone of the past year had shown a loss of £240 odd. I, however, assured the Committee that, in view of our better workings, we should, in any case, show a decent profit next year on the revenue account, and that, if I could only get these new consumers put on, their assistance would be of enormous benefit to us. I therefore secured their consent to negotiate for the supply of the necessary goods on a twelve months' credit system, paying for them (as for the time being was, of course, inevitable) out of revenue—whatever financial arrangement might afterwards be made. The money therefore really came from the consumers themselves.

Supplemental to the Exhibition.—Following the exhibition and the fitting up of the new consumers, we arranged for what I believe to be a most important essential to the perfectly successful installation of gas—viz., a series of homely lectures and demonstrations, most inexpensively carried out, which new consumers might attend and obtain instruction in the use of the apparatus they had lately acquired. These quiet demonstrations and lectures were intensely appreciated, and have not only been helpful to new as well as to old consumers, but likewise have been very useful in securing new customers. To make them the more attractive, we organized cookery competitions among the Board School children, and also among the lady customers. We interspersed the lectures with musical selections and singing competitions among the children.

Finally.—This rambling paper may now be closed with some tabular statements and excerpts from the annual budget of the Gas Department, as published in the autumn of 1904. It is the opinion of the majority of the Gas Committee that the special work required of the writer, and to do which he entered their service, has now been done, and that, in view of the gradual increase of the bank overdraft referred to—now swelled by some £600 to £800 in capital expenditure out of revenue—they must at once revert to the old-time methods of cheap working foreman management.

The following are the excerpts referred to, from the last published statement of accounts of the Gas Department which I am now leaving:—

New consumers were bringing in an income equal to £50 for every £100 put down in their installation.

In spite of the large amount of new work done, the total for wages and salaries for 1903-4, compared with 1901-2, had not, although the profits had been much better, increased by more than 25 per cent.

The income in 1903-4 from £1196 worth of coal was £2556; whereas in 1901-2 an income of only £2406 was obtained from coal costing £1600.

The net works cost this year is only 2s. 7d. per 1000 cubic feet of gas sold, as compared with 3s. 10½d. two years ago.

While in 1901-2 they spent over £1600 in coal, the sale of residuals was £390; this year they have a much larger amount for residuals at something over £400 less in the cost of coal used.

The deficit arising from the year's working during the past four years has been—

Year.	Deficit, Inclusive of Capital Expenditure out of Revenue.	Deficit, Exclusive of Capital Expenditure out of Revenue.
1900-1*	£447 5 10	£447 5 10
1901-2*	957 7 11	957 7 11
1902-3	338 10 7	88 19 0
1903-4	318 13 2	75 5 2

* No capital expenditure.

Tabular Statement showing Comparative Results after Two Years' Work.

	1901-2.	1903-4.
Make of gas per ton of coal	9156 cub. ft.	10,660 cub. ft.
Sale " " " "	7558 "	9,176 "
Actually unaccounted-for	14·1 p. ct.	9·65 p. ct.
Gross cost per 1000 cub. ft. sold	6s. 1d.	4s. 2d.
Net " " " " "	3s. 10½d.	2s. 7d.
Revenue balance, irrespective of capital expenditure out of revenue	*Loss* of £240 18s. 2d.	*Profit* of £676 15s. 3d.

THE CAPITAL EMPLOYED IN THE GAS INDUSTRY BY LOCAL AUTHORITIES.

[Second Article.]

By C. E. Jones, Assoc.M.Inst.C.E.

UNACCOUNTED-FOR GAS.

Exordial.

Having discussed the question of capital and production and their intimate relationship*, it is proposed to direct attention to the distribution of gas, with an endeavour to ascertain what measure of efficiency is secured in the process. In the manufacture and distribution of coal gas, there is in all works a quantity of the purified article, varying from 2 to 20 per cent. (and in extreme cases even 30 and 40 per cent.) of the finished product lost. Voluminal measurement is usually effected by means of station meters; but where these machines are not in operation, the yield of the coal being known, the volume is ascertained on this basis, by calculation. The quantity of gas sold varies from 6467 to 10,683 cubic feet per ton of coal carbonized (see column 12 of table in the first article), a difference amounting to 39·46 per cent.—an ample range affording the undertakings under examination full scope for the exercise, in retailing their staple product, of commercial waste. This wastage was formerly known as "leakage"—a harsh word, only too often truthfully descriptive of what took place—till an ingenious gaseous mind coined the indefinite, and withal elusive, phrase at the head of this article. The euphuism has done duty a considerable number of years, has hidden, and still hides, a multitude of sins of omission and commission. It is worthy to rank with that word so comforting to a certain ancient and pious specimen of femininity—viz., "that blessed word Mesopotamia." In this discussion, wastage, leakage, and loss, being correlative terms, will be used concomitantly with "unaccounted-for gas."

Waste to be Deprecated.

Few will be disposed to dispute the ethical maxim that waste in any form is to be deprecated, or to defend the reprehensible practice of polluting the earth and contaminating the atmosphere

* See "Journal," Vol. LXXXVII., p. 453.

by means of a valuable gaseous product of chemical, physical, and mechanical agencies, entailing the employment of much labour, the exercise of technical attainments, mechanical skill, and financial expenditure. In the economy of Nature, nothing is wasted. In the economy of man, the reverse obtains; and the impolicy of waste in human affairs is abundantly apparent. The familiarity bred of contempt leads to the toleration of trade principles inimical to the common weal, and, *a priori*, the gas industry is a great sinner.

Definition of "Unaccounted-for Gas."

For the purpose of this article, "unaccounted-for gas" is taken to mean the difference, however occasioned, between gas made and gas sold. This disparity is sometimes exaggerated by the fact that no note is taken of gas used in the manufacturing or the administrative departments of the undertaking. As a preventative or check upon extravagant user, thoughtless or accidental waste, the use of a meter is indispensable. All purified gas used in manufacturing operations should be measured and accounted for in the annals of each undertaking. It, however, generally amounts to a small percentage only on the make, and will be disregarded in this discussion.

Causes Producing Differences.

Many and various causes operate to account for the difference in volume between gas made and gas sold. Leakage due to accidental fracture of mains and pipes, loss of gas during structural alterations and charging of new apparatus, gas stolen, inaccuracy in meter registration, and the absence of regulation and correctness of calculation in respect to the consumption of public lamps. Again, in order to ensure mathematical exactness in cubical measurement of gases, it is indispensably necessary that the volumes be measured under identical conditions, or volumetrical corrections to neutralize the differences made accordingly. In the ordinary commercial sale of gas, such theoretical nicety is practically unattainable. Therefore it is certain that the properties of expansibility and contractility of coal gas under varying temperature and pressure will always be responsible for a small proportionable quantity of unaccounted-for gas. But these refined considerations, as also the laws of exosmose and condensation, are well known and understood by gas engineers, and need not be laboured here. It is conceded then that in gas distribution some loss is unavoidable. On the other hand, it is no less true that a high percentage of unaccounted-for gas is singularly descriptive of lax or incompetent administration and incapable management; and the reverse obtains where there is found a minimum of wastage due to distribution.

Cæsarean Passivity.

A careless or cavalierly attitude is not infrequently assumed by local administrative authorities towards this question of leakage; the maximum of indifference being manifested by the greater delinquents in flagrant waste. "What does it really matter when the net cost is so small?" is an observation sometimes advanced. The memoirist well remembers one of these Cæsars of the industry, whose attention when directed to the imposing proportion of his unaccounted-for gas, was in the habit of minimizing its importance by calculating the pecuniary loss—not, be it observed, on the selling price of the finished article, but on the net cost per 1000 cubic feet into the holder, which amounted to, in his case, one-tenth only of the selling price. This kind of sophistical argument is only fit for fools, and furnishes no valid reason or justification for waste; nor can casuistical impudence be deemed a fit qualification for the post of chief of an extensive commercial undertaking. It is little short of an evil in any industry, especially that of gas, that incompetency of this character should be voted to such a position. In these days of strenuous competition in rival systems of artificial illumination, such argumentative profligacy would have incurred the displeasure of Protagoras himself; it is insidious, and might be employed to justify giving away electric current, coal gas, or any other article of moderate cost. There is no end to the consequences of such chop-logic as this, which illustrates the sophistical and deceptive workings of the human mind, and the gullibility of unreasoning listeners. As Butler hath it "There is as much pleasure in being cheated as to cheat."

Connected with Capital.

Inseparably associated with capital expenditure is the significant item now undergoing consideration. It obviously absorbs capital no less than gas sold—with the difference that whereas the latter is productively and profitably employed, the former is a millstone tied to the neck of the undertaking. Like a noisome weed, it grows apace, choking his wholesome brother, and resisting uprootal. The effect of leakage on gas enterprise is parasitical, vampiric, and, in some cases, has proved financially ruinous and fatal. Once gone, the lost gas is irretrievable, and as irrecoverable as the lost tribes of Israel. The cost of its production is thrown away absolutely, its potential energy is lost, its utility destroyed, and its commercial annihilation is complete. But its burden is perpetual, its baneful influence unceasing, the disease chronic, necessitating the imposition of a higher selling price than would otherwise be sufficient to make ends meet, penalizing the patient consumer accordingly. The writer calculates that, taking the gas industry as a whole, no less than £7,500,000 sterling is now employed in the manufacture of gas "unaccounted for"—leakage, wastage, and loss.

Leakage a National Loss.

For the purpose of arriving at the total loss of gas, let us combine the two branches of the industry—*i.e.*, municipal and joint-stock enterprise—as formulated in official returns, and deal with the figural totals. Thus used, we find the volume of gas lost or unaccounted for exceeds 12,846 million cubic feet. It requires a strong mental effort to grasp these figures, so large is the volume. However, to convey a tangible idea of magnitude, it may be said that this quantity of gas is more than sufficient to satisfy the requirements of the city of Birmingham for two years; it is greater than Scotland produces in twelve months, or Ireland in three years. The value in sterling of this volume of gas, at 2s. 6d. per 1000 cubic feet, amounts to £1,605,775. In order to supply this wastage, more than 1¼ million tons of coal, yielding 10,000 cubic feet to the ton, would be required. Taking (say) £6 per ton of coal as the average capital for works and mains, we find £7,500,000 has been expended unnecessarily to feed this dragon of waste. Viewed in relation to the rapid depletion of our coalfields, whose exhaustion it is impossible to restore, this waste assumes the dignity of a national loss, consummately irrational, supremely foolish, and desperately wicked. Retarding, instead of accelerating, the undue depletion of the irreplaceable mineral wealth of the British Isles, especially the coal output, should be the policy of all such as desire to maintain and prolong the manufacturing industries, maritime supremacy, and national and commercial prosperity of "this precious stone set in the silver sea, this blessed spot, this earth, this realm, this England!"

The Danger of Leakage.

Forming with atmospheric oxygen an explosive mixture—most excellent when in a gas-engine, but dangerous elsewhere—the insidious discharge of coal gas into the atmosphere should by all means be prevented, and health, limb, life and property non-imperilled. Since the introduction and extended use of carburetted water gas, containing an appreciable quantity of deadly carbonic oxide gas, which greedily forms with sanguinaceous fluids a coagulated or solid compound fatal to animal life, this becomes the more necessary, and escapes from distributory mains and pipes assume supreme importance. It is imperative they should be rendered of very rare occurrence, if not absolutely impossible. Knowingly to allow such gas to escape is criminal guiltiness, and likely to lead to unpleasant consequences. The danger being known, a remedy to overcome the evil should be found. Human foresight is not slow to perceive that the true remedy is to be found in prevention. Tight mains, pipes, and connections, with increased attention bestowed on the distributory plant and apparatus, is the cure. By the aid of governing bodies, this is achievable. Spasmodic efforts, however, are of little avail. To reduce leakage to the minimum, continuous persistent care and attention are needed. Where the work necessitates the opening of streets or roads, patience on the part of the public should be exercised complacently. Forbearance is an unquestionable duty; often it is a necessity; and frequently our best interests are served by remembering to be forbearing.

What is a Reasonable Ratio?

Fortunately for the credit of municipal administration, wastage in the larger works is not equally great with those of smaller or of medium size. Hence it is that the larger output governs the less, and the mean or average leakage offers a more presentable front than would otherwise be the case. Thus glaring deficiencies and flagrant instances of waste are unrevealed, and the "average" of the whole accepted and pronounced "satisfactory." Nothing is more fallacious than such a fortuitous doctrine of averages presents to an independent and conscientious examination of the intricacies of gas practice and accounts. Averages are elastic and serve many useful purposes. But if fact be the object of inquiry, averages are not entitled to implicit confidence, but every undertaking should be examined separately, weighed in the balance, and judged accordingly. The latter method is the one adopted by the author, with the result that he makes bold to suggest that 3 per cent. of unaccounted-for gas is a reasonable if not an ample allowance.

Years ago, when this question was imperfectly understood, from 10 to 16 per cent. on the make, instead of being condemned as scandalous waste, was admittedly a fair allowance. It was customary among the earlier gas engineers to reserve one-sixth of the consumption for leakage. Except where local circumstances are exceptional—such as districts or towns which are subject to subsoil disturbance by the operations of mining, sewering, or cosmic commotion by blasting, subsidence, landslips, earthquakes, or other cosmological agitation within the area of gas supply—a 3 per cent. goal should be aimed at, and no works considered skilfully conducted whose leakage account exceeds 5 per cent. With the present mean of nearly 8½ per cent., with which most undertakings are evidently content, this figure of 3 per cent. may appear too low to strive for, and some will consider such a saving unattainable; but as the proof of good pudding is in the eating, so experience is the crucial test of scientific theories or dogmatory assertion, and, fortunately for the writer's contention, there are a few able engineers and managers whose experience and practice declare in favour of low figures, as analyses

of gas undertakings belonging to local authorities incontestably prove. Critical examination of some 250 works gives the following results: In one instance the gas unaccounted for exceeds 40 per cent.; in two others 37 and 36 per cent. respectively. Two other concerns exceed 32, and two more 30 per cent., one 28, one 27, one 26, one 25, two 23, five 21, and five 20 per cent. Five exceed 19 per cent., two ditto 18, two 17, nine 16, eight 15, eleven 14, nine 13, seventeen 12 per cent., sixteen 11, twelve 10, twenty-six 9, twenty-one 8, twenty-nine 7, sixteen 6, and eighteen 5 per cent. Coming to more efficient management, we find less wastage. Thus one gives 5 per cent., twelve do not exceed 4 per cent., eight 3 per cent., five 2 per cent., two less than 2 per cent., one 1 per cent., and one less than 1 per cent. The mean of the three lowest is 1·43 per cent., the next five equal 2·55 per cent., and the next eight 3·35 per cent. The mean of the seventeen lowest equals 2·34 per cent.

Thus it is easy to demonstrate that 3 per cent. of gas "unaccounted for" is a reasonable allowance.* Among the highest ratios may be noted seven works over 30 per cent., sixteen over 20 and not exceeding 30 per cent., and ninety-one exceeding 10 and not exceeding 20 per cent. Such waste as this is, of course, indefensible, and can be prevented by the adoption of preventative measures, far too long delayed in the interests of the consumers and ratepayers and the credit of municipal management, progressive enterprise, and democratic ambition. The stereotyped promises of zealous advocates of municipalization of gas supply, of "better gas and more efficient management," so often made to Parliament, are not always realized. But the time is not far distant when no gas-works whose leakage exceeds 5 per cent. will be considered efficiently managed, or the gas properly distributed; and no administrative authority who tolerates any excess of this figure should successfully appeal to the suffrages of intelligent electors. Meanwhile, notwithstanding the figment of "profits applied in relief of the rates," the growth of the latter is vigorous, and the Progressive augmentation of local burdens proceeds apace; a portion of the local finances being annually applied to affect the liquidation of the bankrupt estate of unaccounted-for gas. Such is one of the products of the enthusiasm of this municipalizing age, encouraged, if not upheld, by the governmental facilities afforded for the contraction of debt on the security of rates, already over-mortgaged. Surely there is to be found more folly than wisdom allied with human affairs in all ages, and specially in this, which openly manifests an implacable spirit of unreasoning destruction against all private enterprise of a profitable character.

Cheaper Gas Quite Possible.

Assuming it possible to reduce leakage to 4 per cent.—say, to-morrow—and were it accomplished accordingly, 220 municipal works would be in a position to reduce the selling price of their staple production; and some concerns now being run at a loss would enjoy a measure of prosperity hitherto unknown to them, and the impetus thus given to local trades advantageous to all. Arithmetical examination demonstrates that, without running any financial risk, or endangering the commercial stability of the undertakings, the following reductions could safely be made; and it is submitted that the strongest works are those selling the cheapest gas, and the weakest those which, by maintaining a high price, invite competitive attack. One offending works could concede 26d. and another 21d. per 1000 cubic feet. Two could reduce 17d. per 1000 feet, and others the sums named in the order given: One, 16d.; one, 15d.; four, 14d.; two, 12d.; three, 11d.; four, 10d.; ten, 9d.; five, 8d.; ten, 7d.; sixteen, 6d.; twenty, 5d.; thirty-nine, 4d.; forty-six, 3d.; thirty-one, 2d.; and twenty-four, 1d. Concessions thus made would not fail to considerably stimulate trade, encourage consumption, and secure profitable custom. It cannot, however, be concealed that the above amounts to a formidable indictment of the numerical majority, as distinguished from the bulk of the output of gas, of the management of municipalized gas-works on the popular elective principle, which, however much belauded, has seldom produced any managerical or other improvement tending to the advancement of the industry or those associated with it. Desire of power underlies seductive oratory and officious zeal for the public good. Fortunately there are exceptions which it is a pleasure to observe and chronicle; but they are not by any means common.

Suggested Utilization of Unaccounted-for Gas.

By the distribution, on scientific and economical principles, of coal gas, delinquent concerns may yet become thrifty and capable of satisfying, in these competitive days with no money about and steadily increasing financial obligations, the just and reasonable claims of their consumers to lower-priced gas. Unproductive capital represented by leakage should be utilized, and economy in manufacture and distribution promoted. Success is the achievement of painstaking effort; seldom of fortuity. Sad to say, democratic fervour—a feature conspicuous in the nation's religionism as well as in its municipal life—does not aim at efficient street illumination; and in the birthplace, the home of coal gas, public lighting is a by-word and a standing reproach to local self-government. Our lighting authorities, many of whom delight to live in the exciting current of modernity and rejoice in "enterprises of great pith and moment," yet appear to consider street lighting of small importance, and the advantages offered by improved means of illumination worthy of being ignored.

Fairly-well lighted, as a few thoroughfares of the Metropolis of the world are, London and many other large towns fall as far behind some foreign capitals in this respect, as modern street lighting is in advance of the illuminating agents of a hundred year ago. Here, then, is a use for wastage which can be profitably utilized in improving the lighting of our streets, blind alleys, and thoroughfares of all the offending towns in the Kingdom. Employ what now pollutes the atmosphere to make it bright and radiant—where radiance is rarely seen, diffuse the cheering and enlivening rays of gas-light. Here is a magaificent field for the operations of reforming gas committees—reduce leakage and employ the gas thus recovered in the improvement of public illumination. Such measures may not sound heroic, nevertheless they possess the merit of unobtrusive usefulness and the promotion of public comfort and convenience. Whoever carries this scheme to a successful issue will deserve well of his country. Who will begin the good work of illuminating the abode of darkness, the brightening of the dull lives of honest but indigent dwellers in towns, relieve the monotony of existence in populous centres? To ameliorate the social condition of dense populations, promote good fellowship and friendly intercourse, to cheer the sad, comfort the sick, strengthen the weak, encourage activity, animate idleness, enliven dullness, dispel shadows, create mirth, dissipate gloom, lighten care, to elevate thought and feeling, is true philanthropic practical beneficence; and the most potent though silent agency in the accomplishment of all this is light. In lofty Miltonian diction—

> "Ethereal, first of things, quintessence pure.
> Holy light, offspring of Heaven."

Moralists tells us truly that activity loves light, and inactivity darkness. The passions are excited by penumbrous conditions, they are soothed and rendered quiescent by light, the powers of darkness are challenged to mortal combat and overcome by a ray of light, as falsehood by the shafts of truth. Therefore, should there be luminosity in place of darkness, "light, more light." Multitudes shut up in narrow, congested streets, confined to darkened edifices incapable of reflecting luminous rays—offering, in fact, nearly every obstacle to the optical principle of reflection—hail with delight the diurnal advent of artificial illumination, and joyfully welcome, over their surroundings, the diffusion of light. Its beneficent influence on wretchedness, aggravated by darkness, can only be fully appreciated by dwellers therein, or visitors thereto; and unaccounted-for gas cannot be better employed than in the dissipation of the moral and physical darkness enveloping with depressing force the aims, hopes, aspirations, and spirits of city and town toilers. Here is praiseworthy work for local authorities. May they undertake it in no half-hearted fashion! What said the Sage of Chelsea:—

> "All human souls, never so darkened, love light!
> Light, once kindled, spreads till all is luminous."

Remedial Measures.

Distributory apparatus, however skilfully laid out at their incipiency, from their nature and varying duties eventually develop complication and get out of date. By the impairment of its delivering capacity, some portion of the area of supply, it may be, is inadequately served, and the universal panacea is increased pressure. If the mains and services are in an absolutely tight condition, no harm is done; but should they be defective, increased leakage, in accordance with well-known laws, is inevitable. It sometimes happens that the passage of the gas is throttled by some structural old-fashioned or artificial obstruction, the removal of which would render unnecessary the application of increased pressure. An intelligent examination of the area affected should be made before any addition to the initial pressure is applied, since there are other means at the engineer's command for improving the supply without resorting to the expedient named.

It is admittedly a difficult task to equalize the gas pressure in a district ramified by irregular levels; and it is also morally certain that few earnest attempts to do so are made by the numerical majority of gas purveyors. The coupling up of particular mains would often effect the object desired, without reference to initial pressure; but this would involve some trifling outlay, to which the automaton councillor offers his most strenuous opposition. Therefore it is not done, and heavier pressures are ordered to actuate the district governors, and the wastage is not only augmented but perpetuated. Some committees there are who, dwelling in contentment, prefer their own ignorance to the best technical knowledge that anyone else can give them. Where they are in authority, gas leakage is high and likely to remain so. Shelving reform is an acquired art brought to a high state of perfection; but to be wise too late is evidence of quondam foolishness, the acknowledgment of which, being a mortification to human wisdom, is naturally deferred as long as possible, or perhaps not made at all.

In the writer's former observations on capital employed by local authorities,* allusion to official facilities for contracting local debt was made. Accentuation of the fact is afforded by unaccounted-for gas, which has silently absorbed some seven

* *Note.*—Since the above was written, at the recent meeting of the Waltham and Cheshunt Gas Company, the Chairman, Mr. Alfred Kitt, himself a gas engineer, stated that their leakage was only 3·1 per cent.

* See "Journal," Vol. LXXXVII., p. 455.

millions sterling of unproductive, useless capital. It may be that the Local Government Board are unaware of the existence of such an auriferous maelstrom within the confines of the United Kingdom, and is ignorant of the fact of such a financial vampiric octopod having fastened its suckers on the gas industry, and receives official sanction and encouragement by way of "loans" for so doing. The Local Government Board thus becomes a coadjutor with the borrowers, and equally liable to censure for contamination of the atmosphere promoted and continued by the financial means which it provides. Thus we have a Government Department engaged with local authorities in the nefarious and sardonic work of endeavouring to contaminate respirable air, and poison, by means of gas, His Majesty's law-abiding liege subjects. If it be that the Local Government Board is ignorant of the true aspect of the case—and it is notorious how small a moiety of wisdom is required to make an average legislator—let it be the province of the "JOURNAL" to illuminate the mental darkness and avenues of officialism.

It is not too much to affirm that the remedy for leakage lies with the Local Government Board, whose inspectors have but to withhold their sanction to further loans till the leakage account be brought down to a reasonable figure. The effect that such a decision would have on unaccounted-for gas would be little short of marvellous, and the obnoxious item would ere long disappear, to the manifest interests of producer, consumer, and the general public. Some gas committees, knowing too well how difficult it is to induce town councils and district boards to sanction measures having for their object improvement of the supply—such as raising the salary of an able but underpaid officer, making trifling concessions to small consumers, and other acts of administrative policy tending to consolidation and improvement—would regard with satisfaction some such drastic action on the part of the Local Government Board compelling the defaulting local authority to put the undertaking in proper order, work economically, reduce leakage, and sell gas at a little over cost price. Unless gentle pressure of this character be exercised, no gas committee will advise expenditure out of revenue for this purpose, incur local obloquy, opposition, and court defeat at the November elections. Most chairmen of committees are well acquainted with the exigencies of electoral existence, and hesitate before endangering their popularity and official position by advocating inconvenient reforms in their respective departments.

The refusal of the Local Government Board to sanction further loans till leakages were stopped, would support such gentlemen as these, whose term of office, like that of Justices of the Peace, should be for life, and not for a year, in their efforts to improve the undertaking for the good of the community, and moreover disarm the opposition of the afore-mentioned automaton councillor representing his own interests, or those of his clique, and sometimes his little Bethel, who is as ignorant of good manners as of sound finance; and render, too, the watchful, albeit restless, irresponsible demagogic orator—a genus by no means extinct—*hors de combat*. Again it is urged that the Local Government Board are masters of the situation, and need not hesitate "to hoist the engineer with his own petard;" and if the Board will assert their powers and do this, not only would leakage be reduced to minimum proportions, but unnecessary capital expenditure would be arrested, coal conserved, the cost of manufacture curtailed, the selling price lowered or profits increased, atmospheric conditions improved, and sources of danger to life, limb, and property, removed, the status of the industry, and that of local self-government, advanced, another blow struck at elective tyranny on behalf of true reform, cheaper gas, and increased industrial activity, human comfort, and prolongation of life.

(*To be continued.*)

ESTIMATING CYANIDES, CYANATES, & CYANOGEN.

Commercial cyanides frequently contain cyanates due to heating in the presence of air; and to differentiate these, Mr. Thomas Ewar, Ph.D., has devised a test which he has described before the Scottish Section of the Society of Chemical Industry. The method is based on the decomposition of cyanic acid, according to the following equation: $HCNO + H_2O = NH_3 + CO_2$. The hydrocyanic acid and cyanic acid are liberated by hydrochloric or sulphuric acid from the salt being tested; the former being absorbed and titrated in the usual way, and the latter, which decomposes on contact with water into ammonia and carbon dioxide, is determined by collecting the carbon dioxide, and absorbing as barium carbonate ($BaCO_3$). This figure is checked by the ammonia which remains behind in the flask, combined with the hydrochloric or sulphuric acid, whichever has been employed.

Dr. R. H. A. Plimmer, in a paper recently submitted to the Chemical Society, has shown that silver cyanide and silver chloride may be separated and estimated by a simple method. On boiling a mixture of these salts with dilute nitric acid, he noticed that the latter salt was easily dissolved with the evolution of hydrocyanic acid (HCN); and on collecting this gas in a solution of silver nitrate ($AgNO_3$), it was found that the amount of silver cyanide (AgCN) produced was constant. The quantitative estimation of the cyanide is facilitated when made while freshly precipitated and not dried, as under the circumstances the whole of the hydrocyanic acid is liberated by the nitric acid.

SCOTTISH JUNIOR GAS ASSOCIATION.

Eastern District.

A Meeting of the Eastern District of the above-named Association was held in the Heriot-Watt College, Edinburgh, on Saturday—Mr. A. MASTERTON, the President, in the chair.

The PRESIDENT said that as this was their first meeting in 1905, he had much pleasure in wishing them all a very Happy New Year. As individuals, he wished them good luck, health, and prosperity; and as an Association, he trusted they would go on flourishing and fulfilling, by unexampled success, the promises of their younger days. On looking back, they had much cause for gratitude, as their efforts, on the whole, had been satisfactory. Their excursions, which, up till now, had been the principal feature of their career, had been particularly interesting and enjoyable, and had been taken full advantage of.

Mr. D. BISSET (of Granton) then read a paper, of which the following is an abstract, on

BYE-PRODUCTS OF GAS MANUFACTURE AND THEIR DISPOSAL.

In the manufacture and subsequent purification of gas, made by distilling coal in closed vessels, there are produced, unavoidably, a number of bye-products. Some of these are of a disagreeable character, but nearly all have a considerable value; and it is the duty of the gas engineer to see that an adequate return for them is secured. The success of an undertaking may depend quite as much on the efficient handling and disposal of the bye-products as on the manufacture and sale of the gas itself. I purpose giving very briefly a description of the principal bye-products, and the ways of profitably disposing of them.

Coke.—This is by far the largest bye-product of all. The yields vary with the nature of the coal distilled; but they may be taken as from 60 to 75 per cent. on the coal. No greater change has taken place in the *modus operandi* of a large gas-works than with the handling of the coke; but while there have been many improvements in this respect, very little has been done in the improvement of the quality. If gas undertakings would supply a special quality, very free from ash and having free burning qualities, the amount used for domestic purposes might be considerably increased.

Retort Carbon or Scurf.—Retort carbon is used for electrical purposes—such as the electric arc carbons, or carbon plates for cells. If difficulty is found in disposing of it, its value as carbon can be secured otherwise.

Coal Tar.—This bye-product, along with ammoniacal liquor, is got in the hydraulic main, condensers, and scrubbers. The yield of tar runs from 10 to 15 gallons per ton carbonized. It is a very complex mixture, having a specific gravity of from 1100 to 1200 (water being 1000). It is the source of a wonderful array of substances used in the arts and manufactures. Tar is employed extensively as a preservative of wood and of fishing nets, and for making tar macadamized roads. It is also much used in Dr. Angus Smith's composition for dipping metal pipes for water supplies. In practice, tar is distilled in vertical stills made of mild steel plate. The charge of tar ranges from 2000 to 10,000 gallons, according to the ideas of the distiller. In ordinary stills, the first product that comes over is crude naphtha, accompanied by ammoniacal liquor. The next cut of the still is light carbolic oil, and after that comes heavy pitch oil, and then anthracene oil. These fractions are all run into separate receivers. The residue is pitch, which is run off into open ponds after it has been cooled somewhat. The cuts or fractions of the distillates are arrived at by measuring them, or by taking the specific gravity. Each distiller has his own method. There is a tar still in the market for continuous distillation which is heated by oil fuel, and the products taken off at different parts of the apparatus.

Pitch.—This forms about 60 per cent. of the original tar. It is extensively used for the manufacture of patent fuel on the Continent, and is exported from Great Britain in large quantities for this purpose. It is also much used for street asphalting, and also for making roof felts.

Crude Naphtha Fraction.—This is repeatedly treated with acid and alkalies, and distilled in special stills, yielding benzene, toluene, xylene, &c. The ammoniacal liquor portion is run to the sulphate of ammonia plant, where it is treated with the ordinary ammoniacal liquor. The products from crude naphtha are always separated by their distillation tests. Their specific gravities are so near one another that the hydrometer is of little use. Benzene, for instance, boils at about 80° C., toluene at 110° C., and xylene at 137° C. Distillers as they find the market suitable convert their 90 per cent. benzol and 90 per cent. toluol into pure benzene, pure toluene, and pure xylene. Ninety per cent. benzol and toluol are really mixtures of benzene, toluene, xylene, &c. Special fractionating column stills are necessary for this purpose. Pure benzene and pure toluene boil and distil all over in less than 1° C.; while in the case of the commercial 90 per cent. stuff there is a range of about 34° in their distillation points.

Carbolic Oil.—The light carbolic oil is washed with dilute caustic soda, which combines with the carbolic acid to form carbolate of soda. On neutralizing this with dilute sulphuric acid, crude carbolic acid comes to the surface. This is collected and purified by fractional distillation into the pure crystal. Much of the crude and semi-refined acid is made into disinfecting fluids and soluble

sheep dips. The washed light oil is disposed of after the carbolic acid is extracted, for use in Wells lamps.

Heavy Pitch Oil.—The next grade of oil is used principally for creosoting timber. It contains a fair proportion of naphthalene, which deposits when the oil is cooled and allowed to settle. Refrigerating plant is used in the process.

Anthracene Oil.—This oil is artificially cooled and settled, and crude anthracene is deposited. The cooled mass is passed through filter presses, and the result is crude anthracene. This is purified by washing with naphtha, &c., which extracts some of the impurities, and is finally subjected to a heavy pressure in hydraulic presses. It is then ground into a powder.

Pyridine.—This is obtained from the washings of the crude naphtha by dilute sulphuric acid. Repeated distillation and fractionation are needed to get it to the necessary standard.

Ammoniacal Liquor.—This bye-product amounts to about 40 gallons per ton of coal carbonized. Ammoniacal liquor is a very complex mixture; and a complete analysis of it has yet to be made. It is an impure liquid, with various compounds of ammonia dissolved up in it. The distiller appraises the value of it by finding out the amount of ammonia it contains (1) in free form, and (2) in fixed form. Free ammonia does not mean chemically free, but is a technical term meaning that it is volatilized at 100° C. Fixed ammonia is not volatile, and to liberate it the addition of an alkali is necessary. The distiller tests his ammoniacal liquor; and he knows to a fraction of a pound what he should extract per 100 gallons. Ammoniacal liquor can be worked up in many forms. It can be made into anhydrous ammonia or liquor ammonia of various strengths; and it can also be made into nitrate and chloride of ammonia. Most of it, however, is converted into sulphate of ammonia.

Cyanogen Compounds.—Some gas-works go in for the extraction of the cyanogen compounds in the crude gas. The price secured in the market for the recovered article does not, however, make the gas engineer very enthusiastic over the process. There are various systems for its extraction. It is usual, after the gas leaves the ammonia washer, to pass it through a second washer, where it is scrubbed with a solution containing an iron salt in the ferrous condition in a suspended form along with excess of alkali such as soda ash. The scrubbing liquor gets charged with sodium ferrocyanide; and it is evaporated and sold as a crude cake, or it is purified and made into the commercial crystal. The bulk of the sodium ferrocyanide is not used as such, but is converted into potassium and sodium cyanides, which are largely used in the gold fields for the extraction of gold from ores.

Spent Oxide of Iron.—Oxide of iron in the hydrated form is in extensive use for the purification of coal gas from sulphuretted hydrogen. It has the disadvantage of having no action on carbonic acid; but it is just a moot point whether it is necessary to extract this compound. Carbonic acid is not an impurity in the ordinary sense of the term. It acts only as a diluent, and some authorities are of the opinion that it is more advantageous to leave the carbonic acid in the gas and make up for the dilution by putting in more hydrocarbons.

Spent Lime.—The use of lime as a purification medium is not so general as formerly. There is a large amount of labour in handling it; and in cities there is difficulty in getting it disposed of when in the spent form. The monetary return secured, unless in agricultural districts, is very meagre.

In conclusion, I would just like to emphasize the necessity of the gas student devoting proportionately as much attention to the bye-products as to the main article itself. At present, we distil coal to get gas for light, heat, and motive power. At some future time, however, we may do the very same to get one or other of the present bye-products, or one that has yet to be discovered.

Discussion.

Mr. R. Webster (Granton) asked how the ammoniacal liquor would be taken away from the works if the residual products works were at a higher level. Did they simply pump it, or was some special arrangement required?

Mr. J. Dickson (Dunfermline), referring to Mr. Bisset's remarks about carbonic acid, asked if he found it necessary to put any hydrocarbons into the gas. He supposed he meant enrichment.

Mr. J. Davie (Edinburgh) said that to obtain certain reagents distillation was carried out in fractions. They began, possibly, at a low heat, and got what was known as the benzol family; then they went on to a higher heat, and got toluol. What he wanted to know was whether there was such a fine dividing-line between the two as to permit of their getting them entirely separate, or whether they were content with getting toluol among the benzol, and *vice versâ*. As to the necessity for the addition of any substance to make up for carbonic acid in gas, to his mind that was readily explained; because if they had, for instance, 5 per cent. of carbonic dioxide present in any coal gas of 25-candle power, and if they added another 5 per cent., the illuminating power of the gas would fall, and would require to be augmented by the addition of some other substance. It stood to reason that if they wished their standard of light maintained, it must be done by the addition of some substance which would give a higher mixture of hydrocarbons.

Mr. W. Brown (Lasswade) said, with regard to the disposal of coke, if those who were in charge of large gas-works would seek to comply with Mr. Bisset's desires, and supply a coke of special quality, instead of sending their coke to small places to cut them out, they would be better able to dispose of theirs.

Mr. Dickson remarked that if they left the carbonic acid in the gas, the purification costs would be decreased, but those for carbonizing would be increased, by the necessity of adding either cannel coal or benzol. In a great many cases, he did not think it was necessary to enrich with either one or the other. From splint coal they could get a good heating gas; and it was not so much candle power as calorific value that was now required.

Mr. J. Falconer King (the City Analyst of Edinburgh) described the paper as a very interesting one. He said he did not know very much about the internal operation of gas-works, but he was struck with a remark which Mr. Bisset made about gas managers paying more attention to the purity of the coke they produced. Coke was a splendid fuel. It seemed to him that the great impurity in gas coke was the amount of ash it contained. If this could be reduced, it would certainly be a great improvement.

Mr. H. Rule (Falkirk) referring to Mr. Bisset's remark about carbonic acid, said he thought that for those who were near lime beds, it would be much better to use lime to take out the impurity named.

The President, in closing the discussion, said Mr. Bisset had left very little to be added by way of information or explanation. He agreed with all that the author had said in connection with bye-products, which, by the way, were of a varied nature, and emphasized the duty of the gas manager to see that he got full value in their disposal. As to the suggestion that gas undertakings should supply a special quality of coke, "free from ash, and having free burning qualities," he feared this could only be profitably done in works where the class of coal yielding such quality of coke were within reasonable distance, as the carriage on the coal would largely discount any profit gained from the higher price obtained for the coke. Again, as that class of coal generally produced a low-grade gas, it would, in all probability, have to be enriched. Mr. Bisset's remarks on coal tar, its distillation and products, were clearly and intelligently expressed; yet one could have wished that he had entered more fully into the processes. But in that case he would have had to limit his paper to that subject alone. It repaid any fair-sized gas-works to adopt sulphate plant, as the process was simple, and an adequate return was usually assured. Mr. Bisset had brought under their notice the utilization of oxide of iron and lime for purifying purposes; and he was correct in his statement that the former was more widely adopted, and was even profitable after it had served its purpose as a purifying agent. On the other hand, spent lime was of little or no monetary value, and was disposed of frequently with great difficulty—in fact, it was more of a waste than a bye-product.

Mr. Bisset, in reply, said that if the distance were reasonable, liquor could be pumped to the residual products works, and run by gravitation to the still; but, supposing the distance were too great, the liquor could be put into railway tanks and taken to the place. But it could be pumped to a good distance. As to leaving carbonic acid in the gas, it was a matter for every engineer to use his own discretion upon. At the same time, it had been tried, and was found to be cheaper to leave the carbonic acid in. There was a sharp line dividing benzol from toluol. All those substances had a uniform boiling-point. Mr. Brown bore out what he said about the handling and quality of coke. What he had said about coke, he thought, answered Mr. Falconer King's question about the amount of ash. In large gas-works, they had various kinds of coal, yielding different kinds of coke. If they could separate the cokes, the good coke would find a ready market.

Mr. J. Dickson (Dunfermline) read a paper entitled

NOTES ON THE PRESENT-DAY CONDITIONS OF DISTRIBUTION AND SALE OF COAL GAS.

In the course of his paper, the author said:

It cannot be disputed that the present time finds coal gas the light of the great majority. The latest returns show that there are in these islands upwards of 4½ million gas consumers, and that its price per candle power entitles it to hold pride of place among all known forms of lighting; but if this is the rock on which we are to build our hopes for the future, we are to have a rude awakening. The ever extending employment of gas engines, fires, and cookers, besides the many and varied uses to which gas is put in manufactories, is a matter which is forcing itself upon the gas engineer's attention in a very marked degree; and the development of the incandescent burner tends to revolutionize the present system of manufacture in so far as the photometric quality of the gas is concerned. The proportion of gas used in this country for power and heat is very small indeed when compared with the total consumption; and it were well for us that we looked at this matter squarely and considered our chances. Can it be doubted that there are still great possibilities in the future for our industry as regards the supply of a "heat" gas? Are we to believe that the limits of the use of coal gas for lighting have been reached with a flat-flame burner consuming 5 feet of gas for (say) a 25-candle power light? Is it not possible to conceive the supply of gas for power and heat being taken out of our hands by rivals underselling us, if the supply of high-grade gas is to be kept up for the benefit of

the flat-flame burner? The crucial question is, however, this: Is it in the best interests, either of supplier or consumer, that at this period a high-grade gas should be supplied, when, by the proper development of a lower grade and cheaper gas, a light of from three to four times the value can be obtained? The thing is ridiculous; and, strange to say, almost the only impediment to the supply of a cheaper and better light is the gas consumer himself. The continued reduction in the price of incandescent fittings places in the gas manager's hands the best weapon with which to fight electric light; and the education of the consumer in the way of a reduced candle power must follow as a matter of course. Are we to stand still or move with the times?

Coal gas is now being put to uses undreamt of in the old days. I have prepared from the yearly returns in the "Gas World Year Book" for 1904 statistics dealing with the percentage of slot consumers compared with ordinary, the percentage of cookers in use, and the percentage of lamps fitted with incandescent burners throughout the United Kingdom. These in their different ways are valuable aids to the extension of the use of gas. It would, at the same time, seem desirable to have a record of the total gas-engines and gas-fires in use, the extent to which the incandescent burner is employed in the lighting of private houses, and the consumption of gas as fuel for trade purposes.

Companies, Private Owners, and Local Authorities.

	Slot Meter Consumers. Per Cent.	Cookers. Per Cent.	Incandescent Burners on Street-Lamps. Per Cent.
England and Wales.	32·52	32·22	35·38
Scotland	8·24	9·51	21·60
Ireland	18·42	24·37	14·56

A review of these figures shows us that we in Scotland do not take to the slot meter and cooker so kindly as our neighbours.

It would be useless to attempt to enter into all the phases of the question of consumption per consumer, as there are many channels other than the above that influence the sale of gas; but we cannot help noting that these two appliances occupy a very prominent position in the matter, and we must therefore give to them due credit. Though the data obtainable in arriving at a comparison of the consumption per consumer does not show the amount of unaccounted-for gas, and only gives the annual make, we can form a very fair estimate from this.

Consumption per Consumer.

	Cubic Feet per Annum.
England	38,700
Scotland	21,500
Ireland	42,400

It is worth noting that, from the above figures, Scotland occupies the remarkable position of being able to do with one-half the amount of gas per consumer as compared with Ireland or England. The higher quality gas supplied in the former might be put forward as one of the reasons which tend to this; but then we must not forget that the incandescent burner plays a great part in the lighting of England, with consequently a reduced consumption. This difference of consumption will, I think, be found accountable not so much to lighting as to day consumption for heat and power. At all events, the moral that may be drawn from the foregoing is: (1) That the value of a slot meter as a factor in gas consumption can hardly be over-estimated. (2) In regard to cookers, it has at once to be admitted that, even though a cooker is in the house, the oven will not be used in Scotland to anything like the extent it would in an English home. (3) As to incandescent lighting of street-lamps, it will be found to be a general rule that people going about in well-lit streets require more effective lighting in the home; and the better lighted the streets are, the greater likelihood is there of a more extensive use of the incandescent mantle among the consumers. This is perhaps one reason why the electric light has not retarded the consumption of gas.

I have dealt so far with the administrative rather than the practical side of this question, to which latter I will now confine myself by a consideration of those circumstances which go to render our distributing system more perfect.

The question of efficient distribution hinges a great deal upon the main and service-pipes, which must be maintained in such a condition as to ensure an adequate supply of gas to all consumers, at all times, for all purposes, with a minimum of leakage. A constant though comparatively low candle power and a constant pressure will give much more satisfaction to users than a high candle power and a fluctuating pressure. To give all round satisfaction to the consumer, it is essential for the gas manager to be kept posted up as to the pressure required in the various districts during those periods at which the maximum draught is required from the mains.

The question of a supply of high-pressure gas is still in its infancy; and though I cannot speak with any authority as regards distribution in high-pressure mains, the matter seems so worthy of consideration that I may be allowed to enumerate any impressions formed as to the practicability or otherwise of such: (1) There is no known reason for keeping the velocity of the gas restricted to a slow travel in a large main if the same result can be attained by a high velocity in a small main. (2) With gas compressed at a pressure of from 5 to 10 lbs. per square inch, the reduction in capital charges would be considerable, as pipes one-half to one-third the size would be sufficient. (3) It is a question for the meter makers as to what limits they would set upon high inlet pressures to the present dry meters, and what effect (say) 10 inches of pressure would have on the life of a meter. It has to be noted that, though this is presently a most unusual pressure, it would be exerted equally inside and outside the bellows, and therefore would not do very much harm. Provided the meter is large enough for the quantity passing, an initial pressure on the inlet of 10 inches should not affect the registration of a dry meter, seeing that the pressure on the consumer's inlet as supplied at present may be put down as 20-10ths. But when we deal with pounds per square inch, it would either mean the use of a stronger meter or the attachment of a regulator on the inlet. (4) It would be impossible for us to pass gas at so high a pressure as even 1 lb. per square inch into our existing mains and services, without thoroughly overhauling them; so that it would seem advisable to experiment on this system when supplying a new district, where precautions could be adopted in the jointing, or else confine high-pressure mains to special areas where intensified lighting would be most required, and govern down the rest to low pressure.

It may be taken for granted that the wants of the great majority of householders will in the future be amply met by the incandescent burner, while at the same time gas suppliers must be prepared to meet the demands of street, shop, office, church, and factory lighting with intensified gas either direct from the street mains or compressed on the premises. All atmospheric burners, under which head are included incandescent burners, cookers, gas-fires, and gas-engines require for effective use a pressure of 10-10ths, and a less pressure than this causes lighting-back. It may therefore be put down that the requirements of consumers can only be met by supplying gas at such a pressure as will enable them to have an available pressure on house-fittings, with every gas appliance in use, of 10-10ths. The fixing of a governor on the outlet, set to give a constant pressure of 5-10ths however high the pressure on the inlet, and whatever draught is required from the service, provided always that such is sufficient for all requirements, acts as a check against the extravagant use of gas where flat-flame non-regulator burners are fixed; but where there is a combination of atmospheric and flat-flame burners, a governor set at this pressure is, of course, useless. The most satisfactory results in incandescent lighting are attained by having a screw so that the area of the nipple can be adjusted to bring the hottest part of the bunsen flame into the correct position in the mantle; the air supply being also subject to adjustment.

I am quite aware that in not advocating the governing of incandescent lighting and cooking to a pressure of 10-10ths, I lay myself open to criticism; but after all it is a matter of getting the most effective results from the mantle. The screw at the nipple, although not automatic, is still a regulator, and can be adjusted by users until the most satisfactory light is obtained; while as to cookers, there are many in use which will not give satisfaction at this pressure, and would require something nearer 15-10ths. In large establishments, a governor fixed on the cooker supply-pipe, in order to bring the pressure within satisfactory limits, would certainly pay for itself, and ought to be adopted wherever possible; but I cannot hold that governing down so low as 10-10ths would suit all makes of stoves, as I have tried this pressure experimentally and found it satisfactory with certain makers' stoves, and just as unsatisfactory with others.

Discussion.

Mr. W. Radcliffe (Edinburgh) said he had seen meters made to stand 14 lbs. of pressure. The inside was the same as the ordinary dry meter; while the outside was of cast iron. He thought this showed how makers of dry meters could rise equal to the exigencies of high-pressure gas lighting.

Mr. J. Davie (Edinburgh) referring to Mr. Dickson's remarks about the supply of gas of lower grade at a cheaper rate, said it would be interesting to know something more about this, especially to those of them who had been accustomed to high-grade gas. The efficiency of a gas depended upon its thermal value; and if they reduced the illuminating power of the gas, they would have to use more of it. As to high-pressure gas, he would like to know how Mr. Dickson proposed to produce the pressure. He was afraid some of the holders in Scotland would not be able to deal with gas at a pressure of 9 lbs. per square inch.

Mr. J. Miller (Edinburgh) said they tried high-pressure gas once, in Waterloo Place, with a Keith compressor. It was not a success; but there were great possibilities, no doubt, before high-pressure systems of lighting. Mr. Dickson had referred to the delivering capacity of meters. He (Mr. Miller) thought that if they allowed for each meter half more than the quantity set, they would have great satisfaction. Another point was that if they had a number of burners in a place, and they allowed three-fourths of the total to be on at one time, and put in a pipe capable of supplying this quantity, they would find they would not be far wrong.

Mr. W. Brown (Lasswade) said he should like to know whether Mr. Dickson could give them any figures, or any help, in connection with the pressure required at given points in the district to which the gas was sent out. In his own district, which was very scattered and hilly, he had to supply one part with all the pressure he had at the works—viz., 3 inches—while in another part, rising from the works, he found that if the pressure were 2 inches at the works, it would become upwards of 3 inches, gradually falling to

the farthest point, where it was only 1 inch. For the checking of pressure he had found, during the past two winters, that it answered well to place a small pressure-gauge upon every alternate lamp, and to take the record at certain hours. He found that in streets where there were obstructions in the pipes, there was a great fall in pressure—as much as from 3 inches to 1 inch. When he went to Lasswade, there was only one prepayment meter in the place. His Directors agreed to give them a trial. It was found that, in the summer six months, people who had not previously been consumers burned £2 worth of gas each; and so he was given a free hand to introduce these meters.

Mr. W. Williamson (Leven) asked Mr. Dickson what he considered the extra charge for gas consumed by prepayment meters should be, seeing that by them the consumption of gas was largely increased. In some places it was as high as 10d. per 1000 cubic feet.

The President said Mr. Dickson had treated his subject in a liberal and practical manner, and had exhibited intelligence and clear comprehension of his self-imposed task. With regard to the question of high or low grade gas, the use of the latter did not entirely depend upon incandescent lighting—although this was the most efficient way—but the flat-flame burner could still be of much use, if a proper one were employed. A little more gas would be consumed when such a burner was adopted; but this would be compensated for by the reduced price of the gas. As the subject of main and service pipes had been fully treated by Mr. Dickson, he should not comment upon that point further than to say that, as regarded the size of the mains, the circumstances of the particular case should be considered, and the probable building prospects of the district or locality taken into account. However, speaking generally, one could not err in laying a main of ample capacity. Service-pipes, on the other hand, were comparatively easily dealt with, as the probable requirements of the building could be readily ascertained. It would be greatly to the benefit of the company or the corporation to lay the piping up to the meter, so that it might be of sufficient size to meet the wants of the consumer. Associated with this was the question of pressure; and he agreed with Mr. Dickson that a sufficient and constant pressure was more to be desired and acted upon than a fluctuating one, even with a gas of high quality. As to the effect of high pressure—say, of 10 inches—on the meter, if, as Mr. Dickson said, the consumption passing through it were kept at the badge capacity, it would do no harm to the meter; and if the consumption were as much as one-half more than was indicated on the meter, it would not be working, even then, at too great a velocity. The wet meter, if worked at a high speed, would be affected in the manner mentioned by Mr. Dickson; but, in addition, a considerable quantity of water would be lifted by the drum and run off at the inside of the hood, which would interfere with the flow of the gas, and cause the lights to be unsteady. The fixing of governors on consumers' fittings was a matter which entailed delicate handling, as the situation and circumstances had to be dealt with on their merits; and one had to consider whether one or more governors ought to be adopted to regulate the pressure at various elevations. As to the efficiency of different patterns of cookers, he need only say that, like all utensils employed for domestic purposes, thorough cleanliness and care in use were imperative, otherwise the burners became choked, lighted only partially, and fired-back, causing a disagreeable odour. Then blame was apt to be thrown on either the quality of the gas or the cooker—perhaps upon both—when in reality it was caused by the carelessness of the owner.

Mr. Dickson, in reply, said Mr. Davie had raised some knotty points. Perhaps he should rather have said that by the use of the incandescent burner the value of the gas in candles could be increased three or four times. That was to say, if they had 15-candle power gas, they would get a light of 45 or 60 candle power easily, with an incandescent burner, at a reduced consumption. Having explained his reason for dealing with the question of high pressure, he went on to refer to Mr. Williamson's remarks about the price charged for gas consumed in prepayment meters. He said he had gone into this subject, and found that the average increased price, both in England and Scotland, was 7d. per 1000 cubic feet. This was a question which everyone had to answer for himself. In Dunfermline in 1903-4, during the first quarter, they drew, in prepayment meters, £501; during the second quarter, £688; during the third quarter, £615—making a total of £1804. There were 1517 consumers, giving an average of £1 3s. 9d. per consumer. The average consumption of gas was 5700 cubic feet per consumer. Where a consumer had a big cooker, and burnt 30,000 cubic feet of gas, he should, perhaps, when the cooker was paid up, be supplied with gas at the same rate as others.

The President proposed a vote of thanks to the authors of the papers. and it was heartily accorded.

Mr. Bisset and Mr. Dickson briefly acknowledged it.

Mr. W. M'Crae (Falkirk), one of the honorary members of the District, proposed a vote of thanks to the President, which having been cordially responded to, the proceedings terminated.

Mr. A. J. Jackson, who recently resigned the position of Manager and Secretary to the Padiham District Council, was presented last Thursday evening with a handsome timepiece and pair of ornaments by the employees at the gas-works, as a token of respect and esteem for the kindness he had shown them.

VOELKER INCANDESCENT MANTLE FACTORY.

Sixty or more members of the Junior Institution of Engineers wended their way early on Saturday afternoon to South Street, Wandsworth, where are situated the works of the Voelker Incandescent Mantle, Limited. The members were headed by their Secretary (Mr. W. T. Dunn) in the unavoidable absence of the Chairman of the Institution (Mr. Samuel Cutler, jun.). The visit to the Voelker works was appropriately arranged, as next Friday the members are to be treated to a lecture, illustrated by experiments and lantern views, on the "Theory of the Incandescent Mantle," by that master of the subject Professor Vivian B. Lewes. At the works (where, by the way, in former days the famed old "Bell" matches were produced), the visitors were received by the Secretary of the Company (Mr. W. Clark), the Works Manager (Mr. B. Young). and Mr. S. Mason. Except the range of offices, the buildings are not modern; but if they had been originally constructed for the various operations attending the making of a mantle from spool to packing-case, they could not have been better divided. The Company have attached to the buildings a considerable area of unoccupied land—the whole measuring some 3 acres; and it is clear that, if they are called upon to enlarge the number of their operatives through further increase of business, then some of the vacant ground will have to immediately yield service in the manufacture. At the present time the Company are employing 400 hands; and the total output is 30,000 mantles per day. The combined capacity of the plant and employees really exceeds this; but the margin must, it seems, very soon be overtaken if the recent augmentation of business continues. In considering, however, the relation of the number of hands to the production, account must be taken of the fact that the Company do the whole work associated with the making of the mantles—right away from the winding of the ramie thread on to the proper spools, the knitting of the fabric, and the chemical cleansing of the latter from impurities.

It was very considerate of the Company's Directors (and the kindness was much appreciated by the members) to keep their employees—whose willingness also deserves recognition—at work on Saturday afternoon, in order that the visitors might have an opportunity of seeing the actual processes performed, which is far more valuable from the point of view of instruction than merely inspecting the idle plant and having the methods of manufacture explained. The junior engineers therefore had both on Saturday—the explanation and the practical demonstration; the former being courteously tendered by Mr. Clark, Mr. Young, and Mr. Mason. They found "junior" engineers of the stamp of those belonging to the Institution capable of very searching inquiry; but this only added to the mutual pleasure.

Following the making of the mantles, the visitors first inspected the room in which the winding and knitting are carried on. They saw a large machine on one side of the department winding the ramie yarn from one form of spool on to numerous others of a pattern specially suitable for the knitting-machines employed. Down the centre of the apartment were the knitting-machines; numbering 40 in all, and of the special types required for the production of what are called the single and double woven fabrics. The machines are driven, through shafting and gearing, by a 15-horse power gas-engine; and the Company keep in reserve a 6-horse power steam-engine. The action of the winding and knitting machines had a special interest for the mechanically-trained visitors; and the rapidity with which the long lengths of ramie stockingette were correctly produced was the subject of much admiration. In an adjoining apartment, was seen the fabric being subjected to immersion in an acid solution for the removal of any impurities, and finally being submitted to washing in two large revolving machines. Passing through the fabric drying-room, which is kept at a moderately high temperature, the fabric was seen suspended for drying from widely-spaced rails. The visitors were next taken to the several apartments in which were proceeding the various processes for the cutting up of the fabric into the necessary lengths, the affixing of a fine mesh head for giving that important part of a mantle increased strength, the stamping of the head, the operations of impregnating and wringing, the drying of the mantles on glass shapes, and the sewing of the heads and furnishing them with the suspending loop. In the burning-off room, it was remarked that the operation is conducted somewhat differently from what is customary at other factories in this country. For the burning-off, four large hoods with shafts have been provided. Beneath each hood, and extending beyond it, there is a fixed iron framed stand, which supports a sliding frame, arranged to carry numerous iron bars, on which the mantles are suspended in rows of a dozen. A bar of mantles is placed on the frame, the girl attendant ignites them, and they are burnt off immediately below the shaft ascending from the hood. Another bar is then placed on the frame, which is pushed forward, and the mantles burnt off. This is continued until the capacity of the frame is reached. But in being pushed out from the opposite side of the hood, the bars of burnt-off mantles are carried near to the wall which partitions off this apartment from the room in which the hardening operation is pursued. The bars of mantles are placed by hand on supports in large passage ways made in the wall at a convenient height, and with glazed doors on either side, so that the mantles are fully protected during their brief repose *en route* to the next operation. The Voelker

Company prefer the hardening operation being done by hand, and each mantle treated individually, rather than a number at a time being dealt with by one machine. In the room where this work is proceeding, were benches filled up with, in all, some 100 hand burners, connected, by flexible tubing, to the high-pressure gas supply. High pressure! Mr. Young stated that the gas was being supplied for this purpose at 6 feet pressure. The mantles are subjected to the toughening process without removal from the iron bars upon which they were suspended during the burning-off. The colodionizing-room was next visited; and there the members saw the mantles being submitted to the stiffening process before packing. Passing on, the final operations of trimming and boxing the mantles were witnessed; and with these departments ended what had proved for all a very instructive visit.

Assembled outside the offices again, Mr. A. W. Marshall, on behalf of the Institution, said it was usual on these occasions for the members to give expression to their gratitude to those who had permitted them to visit their works. It was his pleasure, therefore, to propose a vote of thanks to the Directors of the Voelker Company, and to Mr. Clark and the other gentlemen who had conducted them round, for the trouble they had taken, and for the interesting and instructive way in which they had explained the various operations. The Institution tried, as far as possible, to arrange visits appropriate to the subject of the next paper or lecture they were to hear; and this visit had prepared them for the lecture they were to have on Friday from Professor Vivian Lewes. The members cordially endorsed these remarks. Mr. Clark, in response, said he need scarcely say that he should be very pleased to convey to the Board this expression of appreciation. They would be glad to learn of the object which had prompted the members in visiting the works; and he hoped that the party had derived both pleasure and instruction from the inspection.

Of this the members left little room for doubt; and what had been seen was the subject of many conversations as they directed their steps homewards.

SAFELY EXPELLING AIR FROM GAS PLANT.

A recent number of the "Purifyer" contained the following article, by Mr. E. C. Jones, on the above subject.

It often becomes the duty of those in charge of gas-works to expel the air from new pieces of apparatus, from gasholders, and from new installations of street-mains. This, in the vernacular of the gas man, is called "purging," and the writer has been unable to find laid down in any books on the subject of gas manufacture a safe rule to accomplish the expulsion of the air.

It is customary, in the starting of gas-works, to blow out the air through an opening at a point farthest from where the gas is admitted; and the air is allowed to escape until it has a strong odour of gas, when it is taken for granted that the air has been displaced by gas. Sometimes a test is made by lighting the gas through a burner containing a piece of wire gauze, and the fact that the explosive limits of mixtures of gas and air are within so narrow a range has prevented many serious accidents. It is hard to say whether the lighting of gas at such times is due to bravery or ignorance; but if it is due to the former, it usually menaces the property of others than the man with the match.

The use of wire gauze for preventing the passage of flame is dependent upon so many conditions that it may be safely said it is never without danger; and though this safeguard is based on the well-known Davy miners' safety lamp, no dependence should be placed upon it without absolute knowledge of the composition of the gaseous mixture and air, its ignition and flame temperature, the degree of fineness and the strength of the wire gauze. It will be readily seen that it is next to impossible to determine all these conditions; and it is well known that slight changes in them will cause the mixture of gas and air which may theoretically be safely lighted through a No. 16 gauze to explode through a No. 100 gauze.

The writer has successfully used a simple and positive means of determining the amount when all the air is expelled from any piece of apparatus by means of samples of the gaseous mixture taken out of the apparatus as the air is being expelled and tested at a safe distance. All that is necessary to perform this experiment is an ordinary wooden bucket filled with soapsuds. These may be made by first filling the bucket with hot water, and whittling into it a bar of common soap. In connection with this bucket of soapsuds, a small rubber gas-bag, such as is used for stopping 6-inch or 8-inch mains, is used for collecting the samples of gas.

Supposing it is desired to expel the air from a long stretch of large gas-mains, a good sized pipe should be brought to a point 5 or 6 feet above the surface of the ground. At the top of this pipe, it should have a funnel covered with fine wire gauze, carefully soldered round the edge. The size of the funnel is dependent upon the fineness of the gauze, and the enlargement is for the purpose of not contracting the area of the blow-pipe. In this upright pipe there should be a damper, operated by an iron handle, similar to the damper used in stove pipes. This damper may be made of stiff cardboard; and below it there should be an ordinary pet cock. These being provided, the gas is turned into the main, and the damper in the blow-off pipe is then opened, allowing the air to pass out through the wire gauze. When it is desired to test, the damper is closed and the rubber attached to the pet cock, thus obtaining a sample of the mixture obtained in the main. This is then taken to some distance from the point where the air is being blown out, and the tubing attached to the rubber bag is placed in the bucket of soapsuds. By squeezing the rubber bag, the air, or the gas and air, is forced through the soapsuds, forming large bubbles on the surface. The bubbles should then be ignited, care being taken that flame does not reach the gas in the bag. These experiments are interesting as they proceed. First, the air in the bubbles will extinguish the match; then, as the gas becomes mixed with air in the pipe, the bubbles will explode with a loud report. After the danger-point has been passed, the gas in the bubbles will burn; and, finally, when all the air has been expelled, the gas will slowly burn with a brilliant flame. So that, besides knowing that all the air has been expelled, the quality of the gas in the main may be determined according to the judgment of the experimenter. After the air has been expelled, it is simply necessary to remove the blow-off pipe and plug the opening. This is done after closing the valve which originally admitted the gas into the new main.

The application of this method of expelling air from new gasholders is made extremely simple, safe, and rapid by using a blow-off pipe of tin or galvanized iron with a flange of the same material. This blow-off pipe is made as large as possible to allow it to pass through the manhole in the crown of the holder; and it should extend down to within a few inches of the surface of the water in the tank. The pipe may be suspended by a flange of the same material soldered on at a spot where it will rest on the crown of the holder, and hold the pipe in place in the manhole. This pipe should extend upwards to a point above the head of a man, and should be flared out into a funnel, on which is carefully soldered a sheet of fine wire gauze. A butterfly valve, made of paste or mill-board, as previously described, is provided, and a pet cock is placed below the valve. When the gas is turned into the holder, it rises to the crown, and the air is forced downward and up through the blow-off pipe from a point near the surface of the water. It is surprising how quickly the air may be expelled without becoming mixed with gas. The writer has made tests within 10 minutes of each other in blowing out the air from a 2 million cubic feet gasholder, where the first test showed no trace of gas, the second burned with a faint yellow flame, and the third burned brightly, showing no presence of air. This work was done so quickly and well that at no time was it possible to obtain a sample of an explosive mixture of gas and air.

In starting up new pieces of plant in old gas-works, it will be found safe and convenient to blow out the apparatus backward with gas already made, rather than to depend upon new generating sets to displace the gas in the condensers, scrubbers, and purifiers. Many explosions have been avoided in this way. The following is a table showing the air required for the complete combustion of various gases:—

Heavy hydrocarbons ($C_2H_4 + 3O_2 = 2CO_2 + 2H_2O$): 1 volume requires 14·28 volumes of air or 3 of oxygen.

Carbonic oxide ($2CO_2 + O_2 = 2CO_2$): 1 volume requires 2·38 volumes air or ½ volume of oxygen.

Hydrogen ($2H_2 + O_2 = 2H_2O$): 1 volume requires 2·38 volumes air or ½ volume of oxygen.

Marsh gas, methane ($CH_4 + 2O_2 = CO_2 + 2H_2O$): 1 volume requires 9·52 volumes of air or 2 of oxygen.

The danger-point with coal gas begins at 7 per cent. of gas mixed with 93 per cent. of air, and ceases when the mixture contains 23 per cent. of gas and 77 per cent. of air. The range of explosibility in water gas is between 7½ per cent. of gas and 92½ per cent. of air, and 26 per cent. of gas and 74 per cent. of air. Below the minimum amount of gas the mixture will not burn, and above the maximum it will not explode, but burn freely.

The following are ignition temperatures, according to M. Mallard and Le Chatelier: Hydrogen, with the necessary portion of air, ignites at 1020° Fahr., and different mixtures of hydrogen and oxygen and hydrogen and air ignite at various points between 985° and 1100° Fahr. All the different mixtures of carbonic oxide and oxygen or air ignite between 1110° and 1220° Fahr.

Centrifugal Gas-Purifiers.—Two patents have lately been taken out for the construction of gas-purifiers on the centrifugal principle. According to abstracts of the specifications given in the "Journal of the Society of Chemical Industry," in the first, granted to Mr. F. V. Matton, a rotary fan disc is provided on both sides with blades having recesses, the blades on one side being shorter than those on the other. The fan casing carries inwardly extending lugs, arranged in circular series, against which particles carried by the gas are projected by the action of the blades, the recesses in which register with the lugs when the fan rotates. Water is projected against the fan from one or more nozzles passing through the casing. In the second patent, a rotary fan is mounted within a vertical circular casing. A concentric annular plate surrounds the fan a short distance from its circumference, and forms an annular chamber with the casing, from which water is injected into the path of the fan tangentially to its circumference. The casing has an outward enlargement at the centre of each side; a tapering gas-inlet tube, having its end curved spirally, being connected to one side, and a flaring outlet-pipe, likewise having its inner end curved spirally, communicating with the other side.

GAS AND WATER SUPPLY OF DRESDEN.

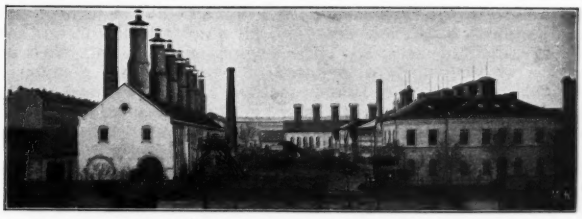
The number of "Public Works" for the current month contains an interesting article on "The Public Works of Dresden," by Dr. Karl Scuteman, a Government Engineer. The author gives an able and comprehensive view of the chief engineering works of the city, accompanied by numerous illustrations. We reproduce, by permission of the Editor, the portions of the article dealing with the supply of gas and water, with some of the illustrations bearing upon these services.

Gas is furnished by two municipal gas-works—one situated in the New Town, and the other in the suburb of Reick. In 1901, the total consumption of gas amounted to nearly 32,688,720 cubic metres (1154 million cubic feet), of which 16,072,350 cubic metres (567 million cubic feet) were produced at the first-named works and 16,616,370 cubic metres (587 million cubic feet) at the Reick works. The system of gas-mains is common to both works, and measured, at the end of 1901, some 583 kilometres (362 miles) in length, including the mains in the suburbs of Blasewitz, Loschwitz, Albertstadt, Mickten, Räcknitz, and Reick; but these figures are now considerably augmented, owing to the boundary extensions already mentioned. At the close of 1901, the number of lamps in use for street lighting totalled 11,770 gas lamps and 680 petroleum lamps. The gas-meters numbered 33,563, and the lights in private houses 330,356. Gas was in addition supplied to 653 gas-engines (with an aggregate of 4916-horse power), 1509 gas-stoves, 3564 sets of installations for engineering, cooking, heating, and other purposes, and 8702 installations for lighting halls and stairways. The rate that is at present charged for gas for lighting purposes is 16 pfennige per cubic metre (4s. 6d. per 1000 cubic feet), and 12 pfennige (3s. 4½d. per 1000 cubic feet) for heating and power purposes.

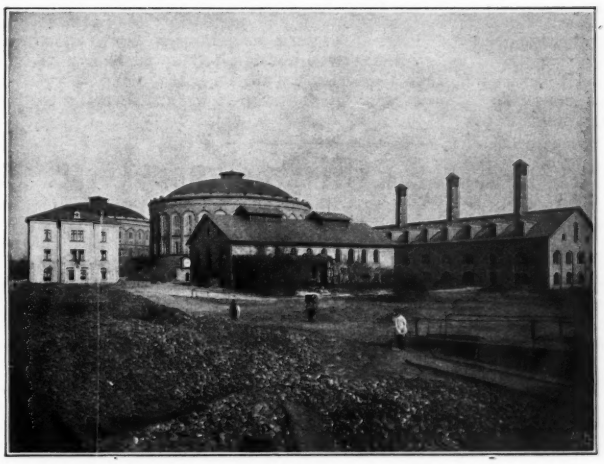
The first large water-works erected in Dresden were those built on the Loschwitz Plain in 1875; and from that time onward to the commencement of the nineties these works supplied the town with an abundance of water for drinking and other purposes. Owing, however, to the continually increasing consumption, the capacity of the plant became overtaxed, and it was found necessary to construct other works, this time in the plain of Tolkewitz, on the left bank of the Elbe. These were in partial working order in 1898; but they were not completely finished until 1901. The construction of a third water-works is already in contemplation, and the necessary preliminary operations have been successfully carried out on a tract of land adjoining the Elbe, in the plain of Hosterwitz.

The intake works at Loschwitz extend along the right bank of the Elbe; while the pumping-station is constructed on the site of a vineyard acquired by the Municipality. The water from the intake is stored in a high-level reservoir situated in the woods at an elevation of 60 metres (196 feet) above the pumping-station, and at a distance of about 1200 metres (1312 yards). The intake consists of a conduit about 1438 metres (1573 yards) in length, at a depth of 14·7 metres (15·4 yards) below the surface of the gravel soil. The water is lifted by steam-pumps operated by six engines working in pairs. The pumps are now in process of reconstruction, so as to secure a capacity of 5000 cubic metres (1,100,000 gallons) per 24 hours with two pairs of engines, leaving the third set in reserve.

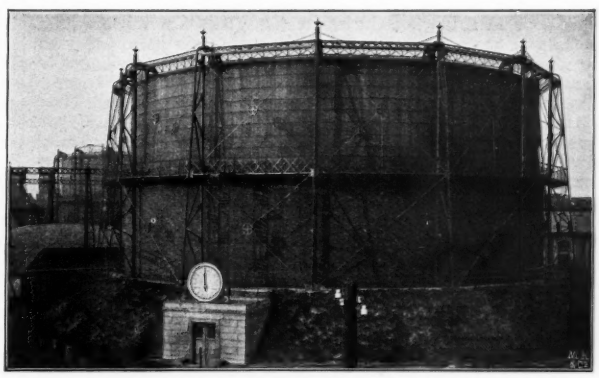
At the Tolkewitz works, the water is derived from eleven wells in meadows adjoining the Elbe. It is syphoned from these wells into pump wells, from which it is delivered either to the distributing system or to the high-level reservoir at



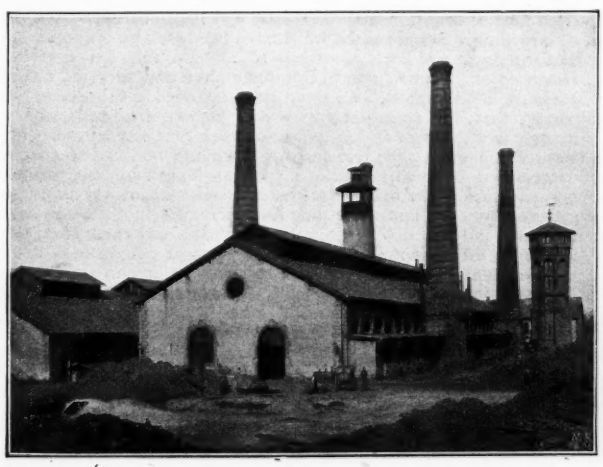
View of the Neustadt Gas-Works.



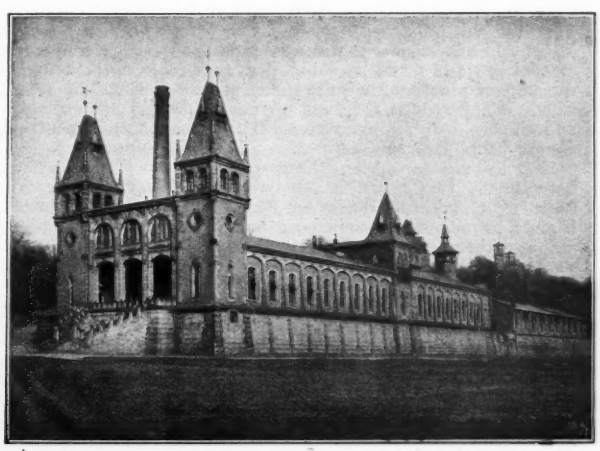
View of the Reick Gas-Works.



The Gasholder at the Neustadt Gas-Works.



The Retort-House at the Reick Gas-Works.



The Pumping Station at the Loschwitz Water-Works.

Räcknitz, as may be desired. The wells are 15 metres (49·21 feet) deep, and the top of the upcast is 112·6 metres (369·55 feet) above sea-level; their height above the surrounding territory being sufficient to prevent flooding, except under very unusual circumstances. The two syphons referred to are below the level of the underground water, and therefore fill automatically during the intermissions of service. Three engines are provided, each of which, working singly at a speed of 40 strokes per minute, is capable of lifting 20,000 cubic metres (4,400,000 gallons) to the high-level reservoir. As one engine is kept as a reserve, the daily capacity of the plant is 40,000 cubic metres (8,800,000 gallons).

At the close of 1901, the total length of water-pipes was 305·8 kilometres (190 miles): the internal diameter ranging from 80 to 750 millimetres (3·15 to 29·55 inches). During the year, the total consumption of water was 3292 million gallons; showing a mean daily consumption of 22·22 gallons per head of the population.

Under the municipal water regulations, the supply of water to all inhabited property is compulsory. A minimum charge of 1 mark (1s.) is levied for each living-room, kitchen, bath-room, and water-closet; and in addition the water-rate is fixed at 12 pfennige per cubic metre (6½d. per 1000 gallons). Up to 1902, the provision of water-meters was not insisted upon, except in special cases; but since then they have been made compulsory. Reductions up to 10 per cent. in the price of water are made to large consumers.

THE LIGHTING ACTIVITY OF THE MANTLE.

The question of the cause of the peculiarly high emission of light from the Welsbach mantle is constantly being brought up again. According to Le Chatelier and Boudouard, and also Nernst and Bose, the Welsbach material can only to a slight extent emit energy of long wave length—that is to say, heat (or ultra-red) rays—and so it reaches more nearly the temperature of the flame than do substances which behave more like absolutely black bodies. Thus the Welsbach material radiates more light the hotter it is, and it is very hot because it does not deprive itself of so great an accession of heat from the flame gases owing to its radiation of heat being less than that of other solid bodies. On the other hand, Killing, and formerly Bunte also, thought that there was a catalytic action on the part of the mantle, which quickened the combustion and thus attained a particularly high temperature. Welsbach himself appears to have favoured this particular view.

Professor F. Haber, of Carlsruhe, has gone into the question afresh, and has communicated his conclusions in a paper in the "Zeitschrift für anorganische Chemie," which is reproduced in a recent number of the "Journal für Gasbeleuchtung." In the course of the researches which he conducted in collaboration with Herr Richardt, as reported in the "JOURNAL" (Vol. LXXXVIII. p. 259), it was established that oxidation proceeds in a particular cone until the water gas equilibrium is destroyed and the oxygen has disappeared. The cone has a base 16 mm. in diameter, and is 20 mm. high; and as its walls are 1 mm. thick, the cubical content of the oxidation space is 0·5 c.c. About 36 c.c. (reduced to ordinary temperature) of gas enter this space per second if the consumption is 4·59 cubic feet (130 litres) per hour, and within it this volume is raised to about 180 c.c., as the temperature is about 1500° C. The gas therefore is in the space for only $\frac{1}{360}$ second, and the reaction of combustion cannot occupy longer than this. Catalytic action could only effect a shortening of this already brief time, and thereby raise the temperature, because within that time the incandescent gaseous mass experiences a certain degree of cooling, which is negligible as the time becomes infinitely small. The rate of cooling of hot gases has been determined by Mallard and Le Chatelier, and found to be most rapid for the permanent gases. In the cone of the flame, however, water vapour and carbonic acid are present as well as permanent gases; but if only the latter were present, the loss by cooling would only amount to 7·4° C. This is a maximum, which would not be reached in fact. It may therefore be concluded that the oxidation at 1500° C. in mixtures of coal gas and air is so rapid that the losses of heat during the time of reaction are quite inconsiderable. Catalytic action, which might reduce the time of reaction, could not effect any appreciable rise of temperature. The same conclusions apply also to yet higher temperatures.

It is to be observed that the space in the actual bunsen flame between the two cones cannot be appreciably cooler than the inner cone, because the outer cone constitutes a hot jacket. Finally, in the outer cone water gas at about 1500° C. burns with air, and there is no doubt, having regard to the high rate of reaction in the inner cone which is fed with cold gas, that no appreciable quickening can occur in the outer cone. It may be concluded that if there is any catalytic action of the mantle at all in the bunsen flame, it is of infinitely small effect on the temperature.

The mass of gas has been regarded as a structure of stationary composition; but if, now, it is imagined as layers of a thousandth of a millimetre, following one another in the direction of the flow, and possessed of differences of energy of oxidation, then it becomes analogous to layers of the mixture of carbonic acid and nitrogen flying over a red-hot mixture of lime and chalk. Each zone rich in carbonic acid forms chalk, while the temperature rises; and each zone poor in carbonic acid forms lime while the temperature falls. The temperature is perpetually rising and falling. Transferring this idea to the two stages of oxidation of the cerium, and taking the energy of oxidation of the water gas as corresponding to the partial pressure of the carbonic acid, Welsbach's notion of millions of changes of oxidation and reduction occurring in a second on the ceria particles is arrived at. As radiation depends on a high power of the temperature, it is conceivable that a solid particle which is subjected to continual changes of temperature many times per second, between 1400° and 1600° C., radiates more light than a particle which experiences a stationary temperature in the equally hot but unstratified gas. Such stratification is at least conceivable. For instance, if the mantle hangs on the outer margin of the burning gas, and this margin undergoes rapid rythmical fluctuations, then in turn water gas and air can reach the mantle, and the phenomenon indicated could occur. It is questionable, however, whether this has any great significance.

Only the properties of the material, and not the form of the mantle, have been considered in dealing with its catalytic action, and the interdependence of catalysis and temperature only has been regarded. Whether catalytic activity of the ceria has any other bearing on the abnormal conditions of radiation cannot now be discussed; but the author thinks it possible that the properties of the form of the mantle may be of considerable importance. This applies both to the superficial characteristics and to the porosity of the material, both of which may be of the utmost importance in regard to the lighting effect per cubic foot of coal gas burnt. The author, however, has only so far dealt with the question whether the matter itself of the mantle raises the temperature of the flame by catalytically quickening combustion; and he thinks it must be answered in the negative.

PUMPING PLANT FOR NATURAL GAS.

In a recent number of the "Engineering Record," an account was given of an installation of plant at Hundred, in Wetzel County (W. Va.), for pumping and compressing natural gas. It was put up by the Carnegie Natural Gas Company—a concern which is affiliated to the United States Steel Corporation—who have already installed compressor capacity equivalent to a yield of 100 million cubic feet of natural gas per 24 hours. This is represented by eight compressors located in three stations, each designed for reserve capacity above the present requirements, so that the eight machines are not always in use. The plant at Hundred contains several new features, which, in view of the attention now given to gas compression in England, it may be of interest to indicate.

First of all, however, it should be explained that the Steel Corporation, at their Homestead, Duquesne, and Bessemer plants, consume about 65 million cubic feet of natural gas every day. This large quantity of gaseous fuel is used exclusively for melting and heating steel in the open-hearth furnaces and heaters; and it comes directly from their gas wells in Pennsylvania and West Virginia, through hundreds of miles of pipes, the main lines varying in diameter from 10 to 20 inches. These pipes are laid just deep enough to be unaffected by frost; and they follow the natural contour of the ground, over mountains and under streams. The sections of pipe are joined by specially constructed couplings (not screwed), which allow for uneven alignment and the unavoidable expansion and contraction, without causing any leakage. The supply of natural gas, however, while still bountiful in certain localities, is gradually diminishing, in spite of the fact that prospect work on new wells is in progress. The average depth of the wells in this territory is about 2800 feet, though some have been sunk to 3500 feet. One drilled to this depth produced 30 million cubic feet per 24 hours. Its rock pressure was 800 lbs. per square inch; and an open-flow pressure through a 6½-inch casing indicated 25 lbs. per square inch. Some record wells have produced 50 million cubic feet per day; and rock pressures of 1100 to 1200 lbs. are often encountered. The Carnegie Company have now several 1100-lb. pressure wells shut in. With natural pressures to this extent per square inch, the strongest valves and fittings are used; and in many cases they are specially constructed for the purpose. The size of the main pipe-line leading from the wells is, of course, determined by local conditions, such as length of line, volume, and pressure. The branch lines at the wells are nearly all 6-inch screwed pipes. The main pipe-line increases in diameter as it nears the point of delivery; and through the mill yards there are a number of 20-inch lines distributing gas at 1 lb. or less. It is thus evident that practically all the energy due to pressure is absorbed in friction. The heating value of the gas is all that is obtained.

Returning to the plant at Hundred, both compressor and boiler houses are built of structural steel, and covered with corrugated iron. The compressor-house is 79 ft. by 90 ft.; and the boiler-house, 46 ft. 6 in. by 95 ft. The distance between the boiler and compressor houses is 41 feet; and the gas cylinders and compressors are at the extreme ends of the plant. The floor in the boiler-house and part of that in the compressor-house is of concrete; while the floor between the compressors is of matched and grooved hardwood. The plant consists of two compressors, six

boilers, and a reservoir arranged to hold an ample supply of condensing water. The size of the high-pressure steam cylinders of the compressors is 32 in. by 60 in.; of the low-pressure steam cylinders, 60 in. by 60 in.; and of the gas cylinders, 21 in. by 60 in. The equivalent capacity in free gas per 24 hours, with an intake pressure of 50 lbs., and running at 50 revolutions per minute, is 15 million cubic feet for each unit, or 30 millions for both compressors. This quantity of gas is discharged into the four discharge lines at a pressure of 30 lbs. per square inch, developing a total of 3000-horse power in both machines. The pressure at the high-pressure steam cylinder is 150 lbs.; the cut-off for the foregoing conditions being at the quarter stroke. The total weight of each compressor is close upon 205 tons. At the point where the discharge gas enters the main pipe-line, the pipe is tapped for an inch pipe, which leads to the compressor-house and to a gas-pressure regulator working in conjunction with the speed governor automatically on the cut-off; thereby reducing the speed below, or increasing it up to, the normal by means of the pipe pressure.

The boiler plant consists of six 250-horse power horizontal water-tube boilers, which are set in batteries of two. Each battery is provided with a self-supporting steel stack 54 inches in diameter and 60 feet high. The grates are covered with fire-brick, so that natural gas can be used as a fuel. Each boiler is fitted with five gas-burners of special design, employing a fine jet of steam to facilitate the proper mixing of the gas and air. Combustion in the furnace is as perfect as can be made, judging from the incandescent appearance and absence of any carbon deposit on the bricks or tubes. The feed water reaches the boilers at 210° Fahr. through an open feed-water heater, which takes the exhaust steam from all the auxiliary pumps, the steam cylinders of the condensers, and the electric light engine, and is also piped for taking water from the hot wells of the condensers. Two low-service duplex piston pumps supply a large wooden tank, having a capacity of 54,136 gallons, with circulating water for the jackets of the gas-cylinders. The tank is placed at an elevation of 20 feet, ensuring steady gravity flow; and after this water passes through the jackets, it is piped to the hot wells. All piping to and from the feed-water pumps is designed for every possible contingency, allowing the use of one or both units in supplying all or any one boiler at will.

All the steam piping is made of wrought iron, and all connections more than 3 inches in diameter are flanged. The flanges in the steam line of 10 inches and upwards are of rolled steel; and the valves and fittings were all tested up to 200 lbs. per square inch. The main steam line and header consist of a loop of 12-inch pipe. By means of this arrangement, liability to shut down on account of any accident to the main steam line is avoided, and there is also a lack of vibration. All the bends are of long radius; and ample provision is made for expansion and contraction. The exhaust piping from each low-pressure cylinder is 20 inches in diameter, and fitted with a gate-valve and an automatic relief-valve for passing the exhaust steam to the condenser or into the atmosphere.

The inlet to the compressors is at the top, the outlet at the bottom, which is the reverse of that ordinarily employed. The four gas-cylinders are connected to a common inlet header made of extra heavy 20-inch pipe and fittings, Its vertical legs are mounted on a 20-inch cross, which permits of two field connections for each, and is designed for separating the sand and dirt from the gas—keeping it out of the gas-compressor cylinders, and thus minimizing the wear on the poppet valves and seats. This header acts as a receiver. The gas is delivered to it in two 10-inch pipes, and owing to the large difference in area between the header and the inlet-pipes, the velocity of the flow is reduced proportionately; thus permitting the particles of sand carried in with the current of gas to settle at the bottom of the vertical legs of the header, where provision is made for cleaning. The outlet-pipe connections are at the bottom (on the inside) of the gas-cylinders, leading immediately below the floor, and out of the building with long radius bends.

Recent records of the intake-line pressures, when the compressors are not in operation, show that they vary from 160 lbs. to 225 lbs.; but when the compressor is operating at 55 revolutions per minute, this intake drops to 65 lbs.—thus delivering 18 million cubic feet of gas per 24 hours with one compressor. This quantity leaves the compressors at 300 lbs. per square inch, and is delivered through 10-inch and 16-inch pipe-lines over a distance of 90 miles. The plant has been in continuous operation for several months, closely maintaining the conditions for which it was designed; the inlet pressure being 55 lbs. to 65 lbs. per square inch with a speed of 55 revolutions per minute. The discharge pressure averages 300 lbs., and the temperature of the discharge is 200° Fahr., while the inlet temperature is 56° Fahr.

Prolonging the Life of Incandescent Mantles.—A recent number of the "Giornale delle arti e delle Industrie" contained the following recipe for prolonging the life of mantles: Dissolve in 200 parts of water 2 parts of powdered chalk, 0·5 part of Chinese clay, and 1 part each of alum and borax. All being finely pulverized, add 2 parts of saltpetre, 1 part each of calcined bone dust and chloride of sodium, and 0·5 part of sal ammoniac. When dissolved, filter the liquid through a silk fabric, and store it in well-closed bottles. When the mantles lose power, it is claimed that they can be revived by being dipped in the solution.

LAYING A SUBMERGED WATER-MAIN.

In previous issues of the "JOURNAL," particulars have been given in regard to the laying of gas and water mains under water. As communications which have reached us from time to time have shown that this information has been found useful, we reproduce, from a recent number of "Engineering Record," the following account of the laying of a main at Waterville (Me.).

A 20-inch water-main was recently laid under the Kennebec River at Waterville (Me.), by Mr. Loring N. Farnum, of Boston, by methods which were unusual in such work. The river is 800 feet wide at the point of crossing; the water averaging about 8 feet deep. The river is fed in part by Moosehead Lake, which ensures a large flow of water at all times of the year. There are several important tributaries, however, entering the river just above Waterville which have a mountainous drainage basin, and therefore the contractor had to be prepared for a sudden rise of water at any time. An ordinary heavy rain at any season of the year will raise the water from 2 to 5 feet. The specifications called for a complete cover of the pipe under the bed of the stream; and consequently it was necessary to dredge a fairly large trench in which to lay the pipe, as the profile of the bottom was irregular, the material varying from sand and river silt to solid ledge rock.

Two lines of piling were first driven across the stream. They were 20 feet apart on centres, and the piles were 10 feet apart. Against the downstream line of piles, at every second or third bent, a spurshore, or brace pile was driven. Each line of piles was capped with three timbers, two of these being 6 in. by 10 in., set on edge, and bolted on opposite sides of the piles; the latter being cut to a tenon 6 inches thick. The third timber was 8 in. by 12 in., laid flat, as a rider cap on top of the other two sticks. All these timbers were 30 feet long, and were placed so that only one joint came on any single pile. This gave at least two timbers running solid by each pile, and made it possible to preserve a fairly straight alignment. The two lines of piling were capped, giving a wooden railroad across the river, 20 feet between the rails. The piles were driven and the timbers put in place with a machine mounted on an ordinary raft made of oil-barrels. The dredging was done with a 1-yard Hayward orange-peel bucket, operated from an ordinary stiff-leg derrick constructed on framework which travelled on the wooden railway.

The city had provided 20 Ward joints for the crossing, and these were used according to the changes of grade in the bottom of the river; putting standard bell and spigot joints in between the flexibles, so that for the greater part of the distance every fourth joint was a flexible one. The pipe was carried into the stream on a scow, and hung up with a common rope sling to a round log placed across the trestle on which the dredge was moved. These slings were loosened, and the pipe dropped in sections as close behind the work as possible, consistent with the flexibility of the joints. The joints only allowed a bend of about 10 degrees; so it was necessary to have ten or more pipes on the slings between the section resting on the bottom and the last pipe hung above the water. As fast as a section had been lowered to a grade, the logs and slings could be moved ahead and used again. This method of pipe laying was adopted as a safe one in view of possible rises in the river. During the progress of the work there was heavy rain, which brought the river up level with the top of the trestle.

The piles were driven in August, but dredging and pipe laying did not begin until the middle of September. This was on account of a large drive of logs running in the river. After these had passed, work was started, and the dredging and pipe laying finished in two weeks. The only difficulty anticipated was that the current in the river would fill up the trench after dredging before the pipe was laid in place. Mr. Farnum was able, however, to continue pipe laying within 24 hours of the dredging, and experienced no difficulty, though one week after the pipe was laid the current had covered it completely, except the part of the channel which was ledge rock or coarse gravel. That portion of the pipe which was not covered by the natural silt of the stream was covered in two days from a scow, taking the gravel from the river bank. Mr. Farnum is satisfied that the method pursued in this work was an economical one, as this point in the river is above navigation. If the dredge had been operated from a scow, the latter must have been built on the spot, and for this work alone. Of the material used in the work, there was very little loss.

Mr. W. M'Crae, Gas Engineer and Manager to the Corporation of Falkirk, has been elected a member of the Institution of Mechanical Engineers.

The Royal Commission on Coal Supplies, after taking evidence extending over nearly three years, and holding 60 sittings, concluded last Saturday the revision of their final report. Two large volumes of evidence, together with short interim reports, have been already published; and the eight hours' sitting on Saturday will produce the final conclusions. Lord Allerton presided. The revised report was ultimately signed, and, it is anticipated, will be published shortly.

LOSSES IN UNDERGROUND STRUCTURES.

A paper on the above subject was read by Professor A. Prescott Folwell a short time ago before the American Society of Municipal Improvements, of which he is President for the current year. He had completed, not long before he read his paper, the uncovering of some miles of water and gas pipe and replacing the pavement; and while doing so he was again forcibly impressed by the enormous loss and inconvenience caused by ordinary municipal and corporate methods of constructing and managing street surface and sub-surface structures. In his paper, he dealt with the various causes contributing to this loss under four headings: (1) Destruction of the street paving by the constant opening of the ground; (2) the cost of digging up and replacing the pavement whenever the underground structures have to be got at; (3) losses due to escapes of gas; and (4) loss of water by leakage. The author pointed out that there are incidental minor losses and inconveniences, such as the thawing of water-mains and service-pipes; the interference with traffic caused by excavations; difficulty of access to, and ignorance of the exact location of, service connections and other appurtenances; and the great confusion of pipes so intricately placed beneath the streets of large cities, &c.

Dealing first with pavements, the author stated that in New York, in 1896, one mile in every four miles of streets was broken up for construction purposes, and one hole required repairs for every 40 feet of paved street. In Brooklyn, during the same year, one opening was made for every 75 feet of paved street. In Boston, in 1897, in about 500 miles of paved streets, there were 14,017 separate openings—about one to every 185 feet—with a total length of openings of 213·4 miles. In Chicago, in 1902, 20,200 permits were granted to open pavements, resulting in about 200,000 square yards of disturbance, or one opening to each 340 feet of street. He said that records of smaller cities were difficult to obtain; but with the spread of wire conduits and steam heating to small cities and towns (which already had sewers and gas and water works), all agreed that the destruction of pavements was increasing rather than decreasing.

With reference to the cost of digging, the author pointed out that this depends largely upon the size of hole necessary, but probably no opening costs less than $3 to $5, *plus* the expense of replacing the paving. This last will cost, if properly done, about as much as the original paving, even when most of the material can be used again—say, at least $1·50 per square yard for all pavements on a concrete base, and 50 c. for macadam. In Washington, the cost of taking up and replacing the paving for street openings during one year, on about 125 miles of streets (100 of which were asphalte and 10 asphalte block), was $47,594·83, or $380 per mile, or 7·25 c. per foot. Assuming one opening, costing $4 for excavating and back-filling, for each 100 feet of street, gives 4 c. per foot for this. Probably from 8 c. to 15 c. per lineal foot of the entire street surface would not be an excessive estimate of the cost of excavating, where the pavement is properly returned.

Coming to the third heading, the author said: It has been estimated that in good practice the normal leakage of gas-mains is 225,000 cubic feet per mile per annum for an average diameter of 6 inches. It is frequently twice this amount; and in some instances three or four times greater. In American practice, leakage ranges from 10 to 30 per cent. of the output. In 1898, 353 plants reported to the United States Commissioner of Labour a leakage of 7·3 to 14·7 per cent.; 163 of these had more than 14 per cent.; and all but 26 more than 11 per cent. If we assume that gas costs an average of 40 c. in the mains, and that there is a leakage of 200,000 cubic feet per mile per annum, this gives a yearly loss of $80 per mile of main, or 1·5 c. per foot. Unfortunately, the greatest loss due to leakage of gas does not always fall upon the gas company, but is found in the destruction of asphalte pavements above such leaks; in many fires of "unknown origin," but attributed by insurance companies to gas leaking into cellars and basements from the ground (the freest outlet when street surfaces are sealed with concrete); in explosions and asphyxiation of workmen in sewers, a large part of the "sewer gas" to which this is attributed being generally illuminating gas; and in the illness of individuals and shade trees.

On the fourth division of his subject, the author remarked that though much had been written about waste of water by consumers, less had been said about loss from the underground mains and service connections. Mr. Dexter Brackett had reported to the Metropolitan Water Board for Boston and vicinity that the tests which had been made in the several municipalities of the district tended to show that the leakage from the street mains and services was very large, and that from 10,000 to 15,000 gallons per mile of main escaped each day into the ground or into some underground channel. In one town of the district, 24,000 gallons per day were found to leak from 1000 feet of main—a rate of 130,000 gallons per mile. Different authorities considered that an average of from 500 to 3000 gallons of water leaked from each mile of well-laid main daily. Taking the average of poorly-laid and well-laid mains, probably 5000 gallons was well under the actual amount in the average plant. At 5 c. per 1000 gallons as the average cost of putting water into the mains, this meant a loss of $91 per mile of pipe, or 1·7 c. per foot.

Professor Folwell explained that for the sake of brevity, few data had been introduced to substantiate the foregoing statements and assumptions; but they were all based upon reliable reports and investigations. The four losses totalled up to from 22·5 c. to 45 c. per lineal foot of street per annum. This was a general average, and some cities might be so fortunate as to suffer much less loss. But the author believed there were more in which the figures were exceeded in the business sections. There were the additional considerations of the annoyance from the breaking up of streets and from odours of gas and objections to water waste. The author thought the correction of each of these objectionable conditions without a radical change of the entire system of underground structures had probably progressed nearly as far as was practicable; but with more care, the joints of sewer, water, and gas pipes, and the house services of each (in which much, if not most, of the leakage frequently is found), could be improved upon.

The author closed his paper with the following remarks: The only solution which can be adopted as satisfactory will be one in which the paving will never need to be torn up until it is worn out; in which all pipes, wires, &c., can be laid without interfering with the paving, and be readily inspected at any time—this being true of service-pipes and wires, as well as mains. The paving can be preserved by not permitting either private corporations or city departments to lay any mains under the streets, but compel them to purchase right of way along private property, or else reserve strips of public property under which all such would be laid. But the other disadvantages are not remedied in this way. To meet them all, a general conduit seems to be the only solution, with small branch conduits for the service lines. It seems probable that the model city of the future will have such conduits, throughout its business section at least, where pavements are most expensive, and such structures most numerous. In them would be placed the small sewers of the separate system, water, gas, and steam-heating mains; while in the walls of hollow tile could be run the telegraph, telephone, and other wires. St. Paul already has something similar to this in its sandstone sewer tunnels, as has Paris in its sewers. Nottingham and St. Helens in England —comparatively small cities—have had such conduits for several years. The advantage of such a conduit is not confined to the annual savings if the structures it contains can be originally laid in it, thus saving the excavating and repaving, which would otherwise be necessary. But the conduit offers other advantages than the financial ones; such as facility of inspection of all pipes, &c., and exact knowledge of the location and condition of each service connection. Also freedom from freezing of water-mains, and ease of thawing them if frozen. The weak point in the argument, and probably one of the principal reasons why more cities have not built these conduits, is that before they are really necessary several of the pipes have already been laid in different parts of the street; and instead of saving much of the cost of laying, the use of the conduit requires the relaying of all of them, or of all but one, round which one the conduit may be built. But, in spite of this, it would seem as though some such contrivance is a necessity, if we are to construct and maintain good paving, and that the time is coming when any city which can afford a brick, asphalte, or modern wood-block pavement, must afford to first place under it a conduit which will preserve it from premature disfigurement, deterioration, and renewal.

COPPER SULPHATE AS A GERMICIDE.

New Method of Water Purification.

In the "JOURNAL" for Nov. 29 (page 690), attention was directed to some remarks made by Mr. D. D. Jackson, the Chemist in charge of the Mount Prospect Laboratory, Brooklyn, in the course of a paper presented to the American Chemical Society, on the use of copper sulphate for the destruction of algæ in water, and also as a germicide. It appears that the discovery of this property of the sulphate is due to Dr. G. T. Moore, the Director of the United States Government Laboratory of Plant Physiology, who says that by its aid it will be possible to destroy in a few hours virulent cholera and typhoid bacilli present in water. The following particulars in regard to Dr. Moore's process have lately been published.

It has been known for a long time that copper destroys bacteria; but the metal has not been much used for the purpose, because scientists have generally believed that the dose required to kill the bacteria would poison the water. Dr. Moore claims that he has discovered how to get the good effect of copper without any dangerous result. He tried many substances with the object of killing, with safety to human life, the algæ in polluted reservoirs, which cause the bad taste and smell of the water supply, and failed. He found success at last with copper sulphate, familiarly known as blue vitriol; and his experiments showed that this substance would destroy all algæ organisms in a small tank in a few hours, and absolutely prevent their recurrence. It dissolves so easily and thoroughly in water that every bit of the copper which does the poisoning is freed to act immediately.

This compound proved so powerful that one part of copper to 10 or 50 million parts of water killed most of the algæ forms. As an illustration of its efficacy, he mentions that the watercress beds of Virginia and other Southern States had for some years become covered with algæ. He dissolved small quantities of the copper

sulphate among the cress beds—one part of copper to 50 million parts of water—poisoned the algæ weeds, and brought about their complete disappearance. The cress remained unharmed. The copper, spreading through the water, attacked and destroyed one vegetable organism, but was powerless to affect the cress.

Dr. Moore's first experiment on a municipal water supply was made in July last year. The town (Kentucky) was small, and the reservoir contained only 25 million gallons of water. It is stated that the water "smelt like a pig-sty, and tasted to match;" but at the end of the third day after the application of the compound the water was "clear, sweet, and completely cured of the disagreeable smell and taste." It had been swarming with anabæna organisms, as many as 7000 filaments to the cubic centimetre. At the end of the third day, tests showed that there was not one left. To make sure that the copper had not poisoned the water, Dr. Moore tested it a few hours after the dose was applied, and found no trace remaining. The cost of purifying the reservoir was $12·50, whereas the town had been spending thousands of dollars each year ineffectually. He next attacked the water supply of a city which had become infected with the typhoid bacillus. By a dose of one part of copper sulphate to 100,000 parts of water, he purified the reservoir, thoroughly sterilizing the water, and checked a threatened epidemic.

Other big reservoirs have been cleared in a similar manner; and up to the present a dozen large American cities at least have successfully purified their reservoirs—not by cleaning them out with spade and barrow, but by sterilizing their water supply. Dr. Moore accordingly claims that people living in towns and cities can be protected from the scourge of disease-infected water by the copper treatment; and he says "the process is so cheap that every small town can afford to adopt it." It may be stated that, under the rules of the Department of Agriculture, he does not make any profit out of his discovery.

It will be of interest to know what Sir William Crookes, who, with Sir James Dewar, is responsible for the examination of London water on behalf of the Metropolitan Water Board, thinks of Dr. Moore's discovery. He is reported to have told a representative of a London morning paper that the sterilization proposed would simply add a fresh and much more serious element of danger than any which can at present be said to exist. The pathogenic microbe at which Dr. Moore aims has, at the worst, only a precarious existence, except during the infrequent periods of epidemic; but its disappearance, as the result of the introduction of copper sulphate, would open the field to the cholera microbe, and leave it to pursue its course without risk of destruction. No good end whatever would, therefore, be served by killing the harmless microbes that now exist in such large numbers. Sir William claims that London "is the best supplied city in the world in respect of its water." He declares that "nowhere can such an elaborate and regular system of water inspection be found as that which prevails in the Metropolis." Sir William is convinced that no water authority in this country would dare confront popular prejudice by adopting Dr. Moore's drastic expedient.

Price of Gas at Filey.—In the course of a report which he has lately submitted to the Filey Urban District Council, Mr. Henry Tobey states that the gas consumption is not growing; and he suggests that the cheaper the price is, the more freely will gas be used. The present price is 3s. 9d. per 1000 cubic feet; and this, he points out, compares unfavourably with neighbouring towns. Under these circumstances, he recommends a reduction at as early a date as possible. The Council have ordered the report to stand over for further consideration.

Incandescent Gas Lighting at Bethnal Green.—Last Wednesday, the Works Committee of the Bethnal Green Borough Council reported having had under consideration an offer from the Gaslight and Coke Company to convert to the incandescent system the remaining 630 flat-flame burners in the public lamps in their area for 10s. per lamp, in quantities of not less than 100; such conversion to consist of reflector and chimney, trap bottom, cock, with clearing-plug, and Bray's burner complete. The Committee had decided (subject to the usual sanction) to have 200 burners converted.

Suicide of a Water Company's Secretary.—The body of a man was found near the Holyhead Breakwater on Monday last week with a bullet through his forehead. It was identified at the inquest on Wednesday as that of William Martin Jones, the Secretary of the Wirral and West Cheshire Water Company. The deceased, who was 47 years of age, lived at Birkenhead, and he left a Holyhead hotel on Sunday afternoon, stating that he was going for a walk. Three cartridges were found in his pocket, and a revolver lay near the body. A verdict of "Suicide while temporary insane" was returned.

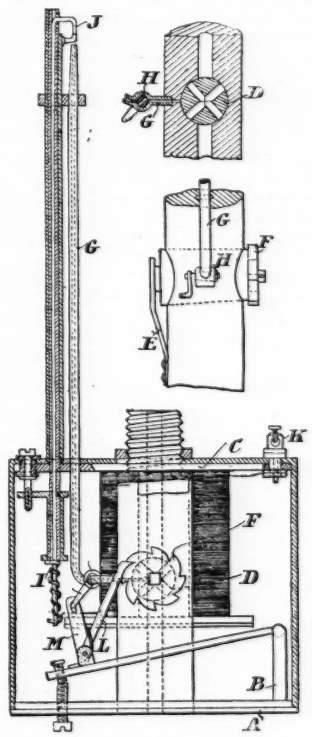
Profitable Gas Supply at Newtownards.—Some interesting facts with regard to the gas undertaking have been placed before the Newtownards District Council by Mr. J. A. Brown, who pointed out that about twenty years ago the works were bought for £9386. The amount of gas made at that time was a little under 5 million cubic feet per annum. At present, they make over 20 millions; and at the end of the financial year the amount will be at least 22 millions. The cost of gas at first was 7s. 1d. per 1000 cubic feet; whereas now some of the large consumers obtain it at 2s. 10d., and the ordinary consumers at 3s. 4d. Since the concern was purchased, it has not cost the ratepayers a penny; and if it were to be sold now, it would bring in at least £30,000. If they took £10,000 off this amount as their indebtedness to the Local Government Board, they would have a clear profit of £20,000. If the undertaking continued as prosperous as at present, it would relieve the ratepayers of £500 a year, or a rate of 9d. or 10d. in the pound.

REGISTER OF PATENTS.

Lighting Gas-Lamps by Electricity.—Gergacsevics, O., of Vienna. No. 24,220; Nov. 7, 1903.

This invention relates to an electric arrangement for lighting gas-lamps from a distance by the opening sparks of a circuit formed through the gas-pipe itself and a return wire provided with branches for each jet. The circuit is closed by an ordinary key for the purpose of lighting or extinguishing the jets; the gas-taps being opened or closed simultaneously.

The device is screwed on the gas-pipe by a tube socket, which supports a bottom plate A, carrying a support B for an armature of a pair of solenoids mounted on a cover plate C, and forming with the latter a horse-shoe magnet. A set-screw in the bed plate A limits the height of the drop of the armature. A multiple way cock D is inserted in the centre of the tubular socket, the conical plug of which may be automatically adjusted by a spring E acting on the broad end. A ratchet wheel F, provided with eight teeth, is mounted on the projecting thinner end of the plug of the cock. A small pipe G, for the pilot flame, branches off at the level of the axis of the cock. In this pipe, a single-way cock H is inserted, which is automatically adjusted in the same manner as the cross-way cock D by means of a spring, and carries



at its thinner end a crank arm. The pipe is bent at a right angle upwards, and, passing through the cover plate, ends above the upper threaded end of the gas-inlet pipe.

By the action of an adjustable spring I, the two hooked parts of the igniter J are pressed against one another with their flattened contact surfaces, the circuit is closed, and the current passes through the pipe in the casing, and finally brought the terminal K into the return wire and back to the source of current. To produce an opening spark between the two contacts J, necessary for igniting the pilot flame, a spring pawl L is pivotally mounted on the armature, and engages with the ratchet wheel C of the cross-way cock. The end of the crank arm on the cock of the branch pipe then engages in a rocking slide or slot on the armature. A set screw is inserted in the armature, the upper end of which screw is coated with a layer of insulating material, and its lower end, in a position of repose, rests on the set screw in the bottom plate A. On a suitable key being inserted in the current conductor, the circuit is closed. When this has taken place, the pair of solenoids are excited, and attract the armature, the ratchet F is moved forward one tooth by means of the pawl L, and the cock is opened; while simultaneously, by means of the rocking slide M, the cock is opened so that the gas can escape through the burner and also through the pipe G. Now, however, the insulated part of the set screw on the armature encounters the lower end of the contact pin on the spring I, and raises it a little; thus separating the contacts J, and an opening spark results. At the same moment, by reason of the breaking of the circuit, the solenoids become non-magnetic or non-inductive and the armature tends to drop by reason of its own weight; so that the contact pin is again drawn downwards by the spring, the circuit is again closed, and the armature is again attracted. This continues in rapid succession so long as the circuit remains closed.

When the lighting has been effected, the circuit is broken, and all the parts return to their normal position, and the illuminating flame burns on, while the pilot flame is extinguished by the cock H being turned back. When the burner flame is to be extinguished, the ratchet wheel is moved forward by the pawl L to the extent of one tooth by another closing of the circuit, so that the cock makes one-eighth of a revolution, and is closed. It is immaterial that thereby the cock H is also opened as the main cock D is closed, and the cock H is in turn closed on

the subsequent breaking of the circuit, which takes place after the burner flame has been extinguished. The set screws must be so adjusted that the armature, when the circuit is closed, only vibrates sufficiently to allow the contacts J, when the armature is attracted by the electro magnets, to be separated a little from one another.

Gas-Governors.—Grieve, G. K., and Peebles, W. Carmichael, of Edinburgh. No. 27,960; Dec. 21, 1903.

This invention has for its object "to improve and simplify the construction of gas-governors, controlling a downward flow of gas, so that they will act in an efficient and reliable manner, while only requiring a comparatively low percentage of the initial pressure of the gas to operate them."

In fig. 1, the governor is made with the inlet A to the casting at the top; and gas passes thence through openings B in the periphery of a cap C, which covers a central or working chamber D. Around this chamber there is an annular space or passage E, by which the gas passes to openings G, communicating with the interior of the chamber at the bottom end and beneath a piston H fitted therein. Communication is also made between the annular space and the central chamber above the piston by an opening J in the side of the chamber, the amount of which opening can be regulated by an adjusting screw K, to control the flow of gas. The piston is on a tubular spindle L, the upper end of which enters into a recess M in the cap which covers the central chamber, and the lower end which communicates with the outlet from the governor, slides in an annular projection N formed at the bottom of the chamber. This projection also serves as a stop to prevent the piston falling below the holes through which gas is admitted to the lower end of the chamber D. Gas from the upper portion of the central chamber is admitted to the interior of the piston

Fig. 1.

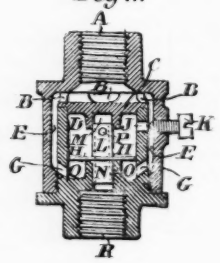


Fig. 2.

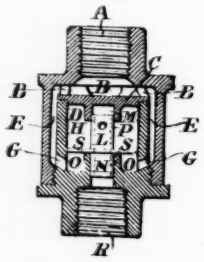
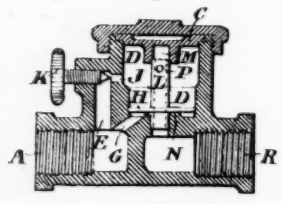


Fig. 3.



spindle through an opening P formed in it. The position of this opening is such that, if the pressure increases and the piston ascends and raises the upper end of the spindle further into the recess in the cap, this movement will cause the opening in the spindle to be partially covered, and thus also cause the volume of gas flowing down the tubular spindle to the outlet R of the governor to be reduced, which outlet may be in direct communication with either a service-pipe or a burner.

Instead of permitting gas to pass from the annular passage E directly to the upper part of the central chamber D, all the gas may be made (as shown in fig. 2) to pass by the opening G into the part of the chamber under the piston H, and thence the amount required for consumption may be allowed to pass through openings S in the piston into the chamber above. The size of the openings are proportional to the volume of gas required for consumption.

The modification shown in fig. 3 differs from figs. 1 and 2 only in so far that the casing is so constructed that the inlet and outlet connections A R are arranged horizontally. Gas passes by the opening (or openings) G to the under side of the piston H; and the gas for consumption passes first to the passage E, and thence, through the opening J controlled by the regulating screw K, into the central chamber D. From this chamber the gas passes, as hereinbefore described, down the tubular spindle L to the outlet R. In this arrangement also all the gas may, if desired, be led first to the under side of the piston and the amount required for consumption be allowed to pass through openings (not shown) in the piston to the interior of the chamber D.

Gas-Burners.—Berend, O.; a communication from K. Kueppers, of Aix-la-Chapelle, Germany. No. 24,287; Nov. 9, 1903.

This invention has for its purpose to produce a blue flame, of high temperature, by leading a blue flame not containing air into a bunsen flame, or inversely.

Fig. 1 shows a vertical section through one form of the burner. Fig. 1a illustrates the kind of burning which takes place. Figs. 2 and 3 show other convenient forms of the burner. Fig. 4 shows a burner in connection with an incandescent mantle.

A is an inner burner tube with an enlarged part at its lower end. The upper end of the tube carries a cap B, provided with small circularly arranged openings, the axes of which are oblique to the tube axis. C is a second tube concentrically arranged around the tube A. O are openings in the lower part of the tube C. D are openings in the upper part of the enlargement of the tube A, which discharge into the tube C. Through these openings air can pass from the outside into the tube C.

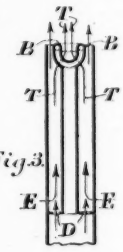
Fig. 1.

Fig. 1a.

Fig. 2.

Fig. 4.

Fig. 3.



If the gas only enters the tube A and leaves through the obliquely directed openings of the cover B, a blue non-luminous, comparatively small, but very hot, flame is produced—hotter than a bunsen flame. If the flame F is not present and only the outer annular bunsen flame is burning, a small blue flame is also obtained, which is, however, of little effect. But if both the inner and the outer flames F and G burn simultaneously, the effect illustrated in fig. 1a is obtained—both flames F and G are combined to a single flame K, the dimensions of which are three to four times larger than those of the single flames, as the outer glowing mantle of the bunsen flame is sucked between the single small blue flames N proceeding from the burner cap, thereby considerably enlarging the whole flame. The suction can best be seen by colouring the flame, which then shows an exterior restriction H. If the outer tube C is somewhat raised so that its end is above the burner cap B, the restriction will disappear and the flame itself becomes broader. The flame thus produced is (if of larger size) hollow inside. The favourable effect of this new flame is said to be probably created by the peculiar chemical reactions taking place in the flame.

In considering the processes of combustion taking place at the surface of the bunsen flame and the inner flame (fig. 1), it will be seen that the bunsen flame itself contains the air of combustion, and will therefore not take any oxygen out of its surroundings. This flame is therefore cooled by the surrounding oxygen and nitrogen molecules, whereby the molecules are heated, but the flame does not benefit in any way from the heat of the molecules. Also the blue flame F is cooled by its surrounding oxygen molecules. But as this flame can only take the oxygen from its surroundings, the heated oxygen will take part in the burning process, thereby increasing the temperature of reaction of the combining molecules, and consequently also of the whole flame K, as the properties of the small flames F are transferred to the whole flame, which is enlarged by the bunsen flame "thus the new flame has a great surface in spite of requiring a comparatively small quantity of gas. The conditions of combustion are also far more favourable, as with a comparatively larger surface of combustion a greater quantity of air, or a greater number of oxygen atoms, are in contact with the flame."

In fig. 2, A is an inner tube provided with lateral openings E. C is an outside tube surrounding the tube A. B is an annular cap provided with openings obliquely directed with regard to the burner axis. In this arrangement, the bunsen flame G is in the centre and leads into the blue pure-gas flame F.

In fig. 3, the burner cap B is of annular shape, and leads the gas-flame into the flame containing air. This latter flame enters the first flame in the centre in the direction of the arrows T and also surrounds it.

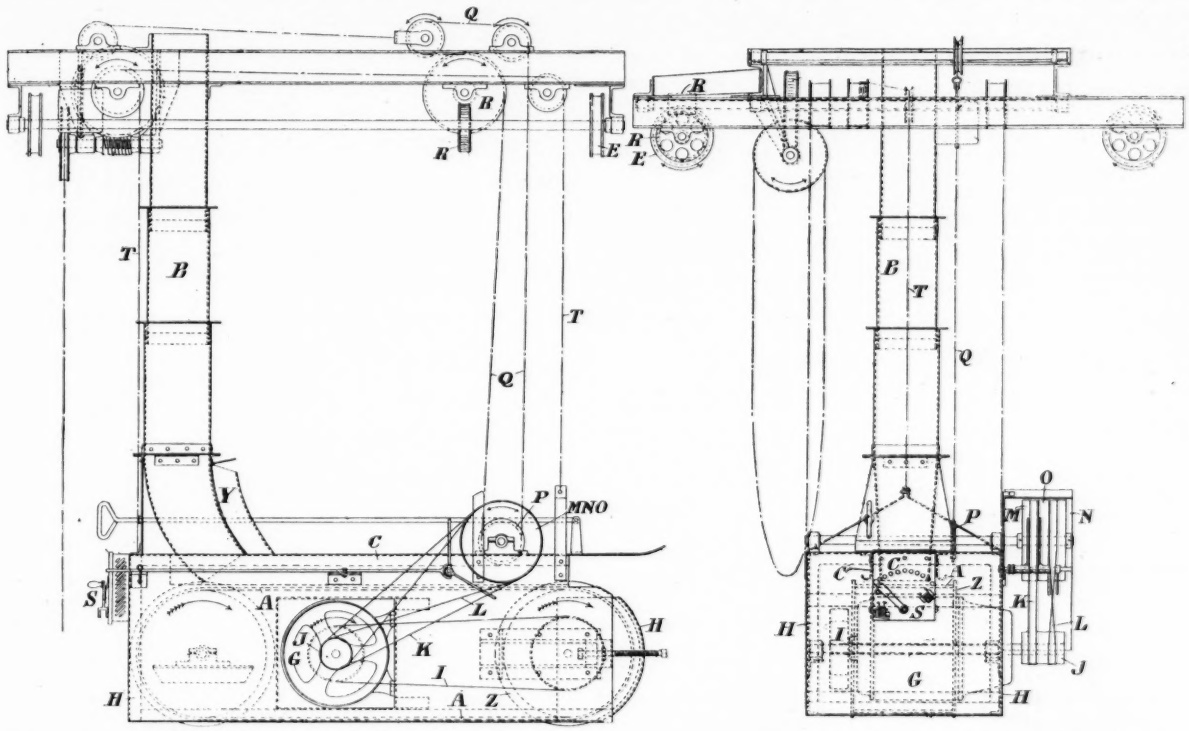
Fig. 4 shows a burner of the kind described, in which the resulting flame is brought into contact with an incandescent mantle or other incandescent body.

Retort-Charging Apparatus.—Graham, M., of Leeds. No. 3321; Feb. 10, 1904.

This is an apparatus for use in connection with horizontal gas-retorts, more particularly where an endless travelling belt—adjustable as to its position and working at comparatively high but variable speeds—is employed to project the coal into the retort at the requisite variable velocity.

A side elevation of the machine is given (p. 107); also an end elevation. The travelling belt conveyor A is arranged in conjunction with a feeding shoot B and a shaped delivery tube or barrel C—the whole being supported on a carriage having travelling wheels running on rails extending along the front of the retorts either overhead (as shown) or at the ground level.

The motive power for driving the belt conveyor and for traversing the carriage is supplied preferably by an electric motor G, fixed either on the carriage or within the casing H (as shown); the power being transmitted to the belt conveyor by a belt I, and to the wheels (for traversing the carriage in either direction) by a pulley J, belt K, crossed belt L, loose pulleys M and N, fast pulley O, chain wheel P, chain Q, and worm gearing R. The motor is provided with a regulating rheostat S, and is controlled from a platform in front of the machine. The charging apparatus is raised and lowered by means of chains T, actuated from a pulley and hand chain by means of worm gearing.

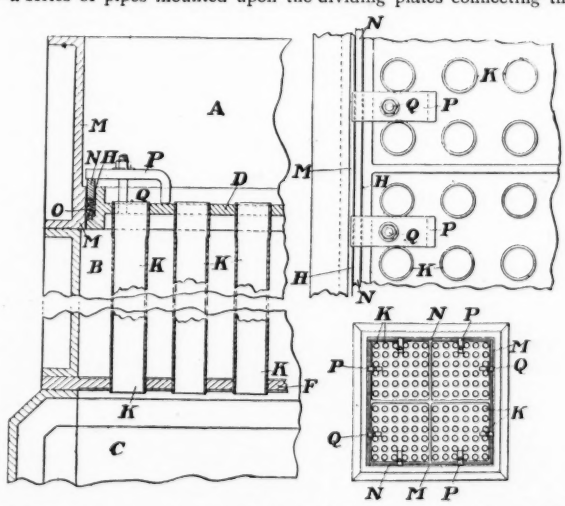


The feed shoot B—which is preferably telescopic, to allow for the vertical adjustment of the charging apparatus—is supplied from a hopper (not shown) provided at the top of the carriage, and so arranged as to give either a continuous or an intermittent feed of coal on to the conveyor belt A, in the same direction as that in which it is travelling—such feed being regulated either by a valve or slide in the lower part of the shoot B, or by an ordinary revolving feeding drum beneath the hopper. In case the latter method is employed, the drum may be so arranged in connection with the belt A, that any variation in speed, effected by the regulating rheostat S of the motor, shall be simultaneously transmitted to the belt and to the revolving feeding drum.

The conveyor is enclosed, from the point at which it receives the fuel to the point of delivery into the retorts, within a fixed delivery tube or barrel C, arranged in line with the bottom of the shoot, or in direct continuation of it, and is provided with an air inlet or valve Y at any convenient point in its length. The tube or barrel is preferably bell-mouthed, and tapers towards its delivery nozzle. The lower or return part of the conveyor belt is enclosed and protected by a screen or casing H, which, at the end adjacent to the retorts, is bent upwards in front of the terminal pulley Z of the conveyor. This screen or casing is arranged in conjunction with a movable flap, controlled by a rod provided on the upper part of the delivery nozzle of the tube or barrel C.

Gas-Condensers.—Clapham, S. B., of Keighley. No. 3721; Feb. 15, 1904.

This condenser is of the class which consists of a vessel or cistern of cylindrical shape in cross section, with plates mounted near each of its outer ends so as to form upper, intermediate, and lower cavities therein—a series of pipes mounted upon the dividing plates connecting the



upper and lower cavities together, so that water may freely pass through these pipes from one cavity to the other without entering the intermediate chamber. The improvement consists in the application of means whereby expansion or contraction of the connecting tubes or plates is allowed without causing injury or unnecessary strain to any part of the condenser.

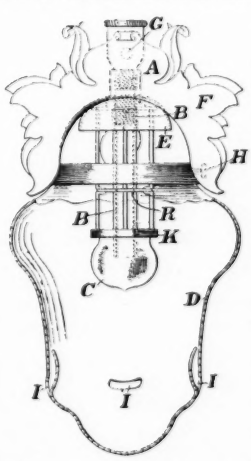
The illustration shows from above a condenser having the improvements applied to it; also a sectional side elevation, drawn to an enlarged scale, of portions of the condenser, and a view as seen from above.

The three chambers or cavities A, B, and C are separated from each other by plates D and F. The upper and lower chambers are connected by pipes or tubes K, through which water passes in order to condense the gases admitted into the chamber B. One or other (or both) of the dividing plates D and F (but preferably the upper one D as shown) are so shaped that a groove or channel H intervenes between it and the outer walls M of the condenser (the lower part or lip of, or on, the plate D being made to extend beneath the groove or into the furrow, in order to retain the parts hereafter explained, whereas if the plate F was loose, or of the form described in connection with plate D, then the lip or extending part would be at the upper edge of the plate, so that the other parts might be on the outside, or within the cavity C); and within this groove or channel H, it is arranged to take suitably shaped framework or strips of metal N. Packing material O is placed in the groove H beneath the frame; and arranged so as to bear upon this latter is a suitable number of clamps P mounted on bolts Q—their pressure upon the frame being adjusted by means of nuts.

In this way, although a gas-tight joint that will withstand high pressures is made between the dividing plate D and the walls M, the plate D [or plates D and F] is capable of moving to accommodate itself [or themselves] to allow expansion or contraction of the tubes K or of the plates D and F. The tubes K may be mounted upon, or connected to, the dividing plates D and F by any suitable means—those shown being placed within the openings in the plates D and F, and afterwards enlarged or expanded to tightly fit therein.

Inverted Incandescent Gas-Burners.—Jackson, W. H., of Halifax. No. 3726; Feb. 15, 1904.

The patentee proposes to make the burner-tube B of cast iron, and line it with a loose heat-resisting porcelain tube to prevent overheating.



Above the upper end of the tube is a porcelain dome E, which arrests any solid matter arising from the flame, prevents overheating of the mixing-chamber A, and diverts the waste gases into the openings between the arms of the canopy above. This canopy F consists of a number of arms, which radiate outwardly and downwardly—the sides of each arm being turned up to form curved channels, through which a supply of pure air is conveyed from the outside of the shade D to the mixing-chamber by inlets G. The design of the canopy is such as to retain a trough of channel or semi-circular section; while at the same time the ornamental edges of the arms further deflect the waste gases, escaping from under the dome E, away from the air supply and the mixing-chamber.

Where globes for inverted incandescent gas-lights are open at the bottom, or have air-holes at or near the bottom, the inrushing air impinges directly upon the mantle, and is apt to cause flickering and unsteadiness in the flame. To avoid this, the bottom end

of the shade is closed; but there are openings I, constructed as shown, so as to deflect the air against the inner side of the shade, and thus prevent its proceeding directly to the flame.

Incandescent Gas-Burners.—Sutcliffe, H., of Halifax. No. 4049; Feb. 18, 1904.

This invention has for its primary object to produce a burner by which substantially perfect combustion of the gas and air mixture is obtained, and the length of flame increased so that the mantle (preferably of increased length) is "raised to a high degree of incandescence from the bottom to the top—the waste or unconsumed gases escaping from the upper end of mantles of the present construction being avoided or considerably reduced."

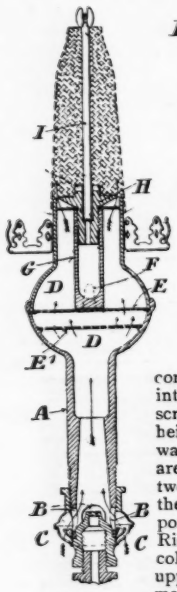


Fig. 1.

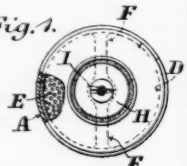


Fig. 2.

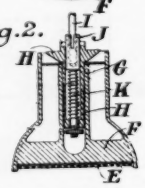


Fig. 1 is an elevation and plan of the burner, and fig. 2 shows the upper portion of a burner fitted with a modified form of mantle prop.

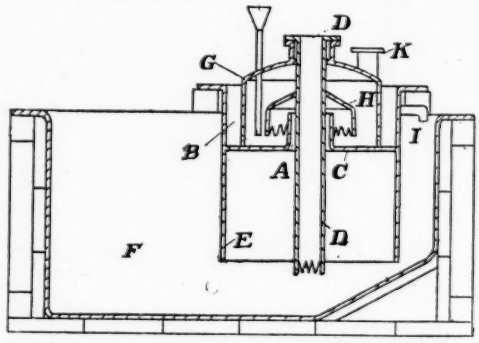
A is the gas and air inlet tube, provided with the usual air admission openings B at the lower end. These openings are controlled by the perforated metal cap C having an internally screwed boss riding on the externally screwed lower end of the tube. At a convenient height on the mixing-tube is formed the bulb or outwardly expanded chamber D. Within this chamber are perforated diaphragm plates—in this instance two—E, E¹; the former being in the lower portion of the bulb and the latter in the upper part. The upper portion of the gas and air tube has a cross-bar F. Rising up centrally from it is the hollow pillar, column, or standard G, in the internally screwed upper end of which is secured the support H for the mantle prop, and also acting as a flame spreader.

In fig. 2, a yielding prop support is shown. In this arrangement, the support H is provided with a short tube or sleeve J in which the end of the mantle prop I is placed. Projecting from the sleeve is a stud or pin on which is a spiral spring K confined between the underside of the sleeve and the bottom of the support H. A nut permits the tension of the spring K to be adjusted when required.

Sulphate of Ammonia Saturators.—Zimpell, K., of Stettin, Germany. No. 23,379; Oct. 29, 1904. Date claimed under International Convention, March 30, 1904.

In patent No. 6891 of 1904 an ammonium sulphate saturator was described, wherein the unabsorbed gases collected in the bell of the main saturator pass into an auxiliary saturator built in the bell. In this arrangement, the unabsorbed gases come in contact with the wall of the bell (which is surrounded by atmospheric air) before they pass into the auxiliary saturator. Thus, under some circumstances, these gases are cooled to some extent. Moreover, the apparatus being closed, the progress of the saturation cannot be seen, and the density, and therefore the absorbing power, of the acid cannot be watched, or can be watched only with the aid of special appliances. Again, a deposit of salt that often happens cannot be recognized, so that the gas inlets and overflow are liable to be stopped by the deposited salt without the attendant observing it, and working must cease until the salt has been removed. The present invention relates to a saturator in which these objections are removed.

In the saturator tank F is suspended the bell E, the cover C of which forms the bottom of the auxiliary saturator tank B. The latter is open at the top, and has a short central pipe A extending upward from its bottom—thus making communication between the bell E and the tank B. The pipe A is covered by a bell H connected with the pipe D, which conducts the gases into the main saturator. The lower edge of this bell is serrated for the better subdivision of the gases. A second bell G covers the bell H, and is provided with an escape pipe for gases K, and a funnel extending nearly to the bottom C. The bell



G is fitted gas-tight to the pipe D, and has gaps in its lower edge. The tank B has an overflow I through which the excess of acid passes into the main saturator tank.

The ammoniacal gases delivered though the pipe D beneath the surface of the acid in the tank F are in great part absorbed; the unabsorbed portion collecting in the top of the bell E, where they warm the bottom of the tank B and pass up the pipe A into the bell H, which dips beneath the acid in the tank. From this bell they pass through the acid into the bell G, parting with the last portion of their ammonia. The waste gases then escape through the pipe K.

The gaps in the lower edge of the bell G allow of a constant interchange between the acid outside the bell and that within it; and as the tank B is open, the concentration of the acid in it can readily be ascertained. By adding fresh acid down the funnel, the concentration or quantity of the acid may be maintained. The gaps also ensure that the boiling movement of the acid under the bell G, caused by the rising gases, is not transmitted to the acid outside the bell; and thus a quiet and uniform overflow of the acid through the pipe is obtained.

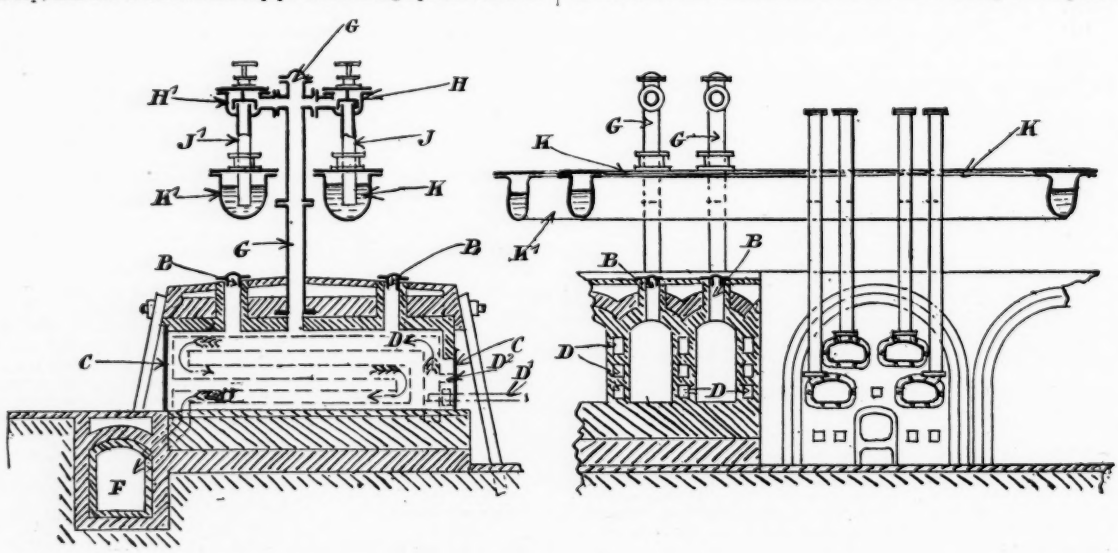
Producing "Superior Coke" in Connection with Gas-Works.—Breckon, J. R., of Sunderland. No. 24,293; Nov. 10, 1904.

This invention relates to the construction of new gas-works and adapting existing gas-works, and making additions thereto and combinations therewith, whereby "a kind of coke much superior to ordinary gas coke is produced," suitable for blast-furnaces and the like.

These results are obtained in the following manner: For the production of the coke there are one or more ovens or retorts of suitable dimensions and construction made of fire-brick or other material, and having facilities for charging them with coals, and for drawing or forcing the coke therefrom. In the process of converting the coal into coke, the gas from the coke is conveyed from the oven or retort by suitable pipes and valves to the hydraulic main of the gas-works, where it mixes with the ordinary and general supply of gas as produced for heating or lighting purposes. There may also be a separate hydraulic main for the purpose of keeping a portion or the whole of the gas produced by the ovens separate from the ordinary gas produced at the gas-works. The gas so conveyed through the separate hydraulic main may be run, if desired, into a separate holder and used for heating the coke-oven flues or for other purposes as desired.

The invention is illustrated by a vertical longitudinal section through the middle of one of the ovens, and a front elevation of an ordinary gas-works retort setting with a vertical cross section of two coke-ovens.

The oven has openings B for charging in the coal. C are the doors at the front and back of the oven, by which, when open, the coke may be forced or drawn from the oven when the coking is completed. D



are flues on each side of the oven, where gas is consumed for heating the coal in the oven. The arrows indicate the course of the gases from the flues of the ovens in their progress to the chimney flue F, where they are carried off in the usual way. There are one or more gas-pipes D^1, with or without bunsen or other form of burner, to supply the necessary amount of gas from any suitable source for consumption in the flues D; and there are holes or openings D^2 into these flues of sufficient size and number (with regulators) to supply air enough for perfect combustion therein. The gas given off from the coal during coking in the ovens is drawn off and conveyed through the pipe G, stop valve H, and pipe J to the ordinary hydraulic main K, and there combined with the gas given off by the ordinary retorts of the gas-works. H^1 is the stop valve, and J^1 a pipe leading from the pipe G to the special hydraulic main K^1.

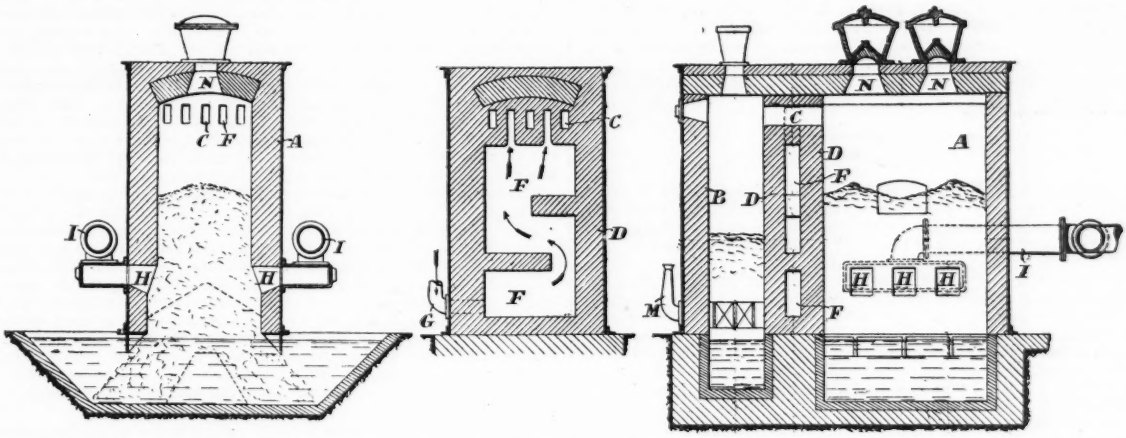
Obtaining Producer Gas Free from Tar and of High Calorific Value.—Desgraz, A., of Hanover. No. 24,333; Nov. 10, 1904.

According to this invention, the heat for distilling the coal is obtained by prepared producer or other gas, derived from any suitable source, and mixed with the air necessary for combustion; the gas and air being admitted to the upper part of the producer, so that combustion takes place above the upper surface of the fuel, and the products of combustion are conducted downwards through the fuel. The air for combustion is supplied in excess, so as to furnish the necessary oxygen for the combustion of the coal, and may be advantageously preheated. The heat necessary for the distillation of the upper layer of coal is given by the combustion of the prepared gas, which takes place in the upper part of the producer. The combustible gas required for the starting and maintenance of the combustion of the coal can either be generated in a special auxiliary producer, adjacent to the main producer, or be derived from any other source and conducted to the main producer.

A producer with water seal, suitable for carrying out the process, and in which the generation of gas for starting and maintaining the combustion is effected in an auxiliary or subsidiary producer, is illustrated.

The main producer A is fed with fuel through two openings N. At the end of the producer is built the auxiliary or subsidiary producer B, communicating with A by passages C. The wall D between the two producers is formed with passages or chambers F, so that the air entering through the pipe G will be preheated before passing into the main producer. The drawing off of the generated gas is effected through openings H, of which three are shown in each side wall. These openings lead into two tubes I, which are connected with a gas exhauster. The high temperature of the producer gas can be utilized for some purpose—such as the generation of steam.

The working of the apparatus is as follows: The main producer A is first partially filled with fragments of limestone, and then the fuel is



introduced through the openings N. The gas for actuating the main producer is generated in the auxiliary or subsidiary producer B by the admission of air through the pipe M. By means of this gas and the air entering through the chambers F, the fuel in the producer A is burned from the top downwards. Hence, as the gas must pass downwards through the incandescent coal to underneath it, "a producer gas is obtained which is absolutely free from coal tar and aqueous vapour."

APPLICATIONS FOR LETTERS PATENT.

28,340.—Akester, W. H., "Incandescent burners." Dec. 27.
28,346.—O'Connor, H., "Wet meters." Dec. 27.
28,359.—Pledath, M., "Inverted incandescent burners." Dec. 27.
28,360.—Spencer, W., "Purifier grids." Dec. 27.
28,380.—Kelsey, W., "Gas-brackets." Dec. 27.
28,405.—Scott-Snell, C., and the Air Light Company, Ltd., "Incandescent gas lighting." Dec. 27.
28,417.—Helps, G., "Mantles." Dec. 27.
28,457.—Bachmann, W., "Four-stroke cycle internal combustion engines." Dec. 27.
28,627.—Thompson, W. P., "Gas-turbines." A communication from Uhlenhuth, E. Dec. 28.
28,642.—Jauncey, P. H., "Incandescent burners." Dec. 29.
28,681.—Sharp, J., "Rotary exhausters." Dec. 29.
28,689.—Maddox, T. W., "Globe carrier." Dec. 29.
28,707.—Wesselsky, L., "Gas-generators." Dec. 29.
28,713.—Lord, W. T., "Reflectors for street-lamps." Dec. 29.
28,765.—Marechal, J., "Purifying gas." Dec. 29.
28,796.—Altman, J., "Inverted incandescent lamps." Dec. 29.
28,803.—Lentz, H., "Gas-turbines." Dec. 29.
28,818.—Giorgi, A., "Igniting and extinguishing burners at a predetermined hour." Dec. 29.
28,897.—Mills, W., "Acetylene generators." Dec. 30.
28,909.—Justice, P. M., "Lighting and extinguishing gas-lamps." A communication from Gregg, F. M. Dec. 30.
28,960.—Fielding, J., "Gas-producers." Dec. 30.
28,966.—Kerpely, A. von, "Gas-generators." Dec. 30.
28,983.—Oldenbourg, E., "Mantles." Dec. 30,
28,988.—Goulton, W., "Manufacture of acetylene." Dec. 30.
28,995.—Gallagher, R. W., "Bill delivery mechanism for meters." Dec. 30.
28,997.—Meyer, A. G., "Treating creosote." Dec. 30.
29,031.—Edwards, E., "Gas-engines." Dec. 30.
29,047.—Tourtel, J. M., "Coin-freed apparatus." Dec. 30.
29,096.—Broel, F., "Automatic igniter and extinguisher for gas-lamps." Dec. 30.
29,126-7.—Job, L. K., "Advertising by means of gas-lamps." Dec. 30.
29,170.—Towns, W., "Gas-producers." Dec. 30.
29,206.—Blakiston, R., and the Palatine Engineering Company, Ltd., "Meters." Dec. 31.
29,212.—Tweedie, R. O., "Acetylene torch for ordinary and incandescent gas lighting." Dec. 31.
29,263.—Negal, M., "Inverted incandescent burners." Dec. 31.
29,343-45-46.—Down, H. L., and Wiseman, D. H., "Gas igniting and extinguishing apparatus." Dec. 31.
29,407.—Westwood, W. H., Wright, E. T., and Westwood, W. W. S., "Hydraulic mains." Dec. 31.
29,415-6.—Wildschiodtz, C. C., "Lighting and extinguishing gas-lights at fixed times." Dec. 31.
29,446.—Sugg, W. T., "Compressing gas." Dec. 31.
29,474.—Cutler, S., jun., "Gas-purifiers." Dec. 31.
29,475.—Moreno, L., and d'Antony, A., "Combustion of gas." Dec. 31.
29,479.—Baudry, A., "Distilling tar." Dec. 31.
29,491.—Lyle, J., "A continuous retort." Dec. 31.
29,503.—Bonnechose, G. C. E. de, "Rotary apparatus for gas." Dec. 31.
29,555.—Blanchard, A., "Supporting inverted mantles." Dec. 31.
29,569.—Beal, W., "Incandescent burners." Dec. 31.
29,610.—Hatton, G., "Regenerative furnaces." Dec. 31.
29,628.—Scharbau, H., "Gas-turbines." Dec. 31.

Fog and Gas Consumption at Rochdale.—Rochdale proved no exception in the matter of gas consumption during the foggy week at Christmas time. The total quantity sent out in the six working days between Dec. 18 and 25 amounted to 17,227,000 cubic feet, which is the largest amount ever delivered during a similar period. The Tuesday's consumption was the highest for any one day; being 3,207,000 cubic feet. These figures were closely approached on Friday (Dec. 23), and again on Wednesday (Dec. 28). Dec. 6 last, however, holds the record for production of any single day; the quantity then made being 2,530,000 cubic feet.

Improvements at the Birstall Gas-Works.—Some time ago, Mr. J. D. Overing, the Gas and Water Manager to the Birstall Urban District Council, pointed out to the Council that the gas-purifiers were out of date (having been in use for about forty years) and inadequate, and that new and more efficient ones were needed. The Council agreed to have new ones; but as the money will have to come out of the profits, it was decided to put in only one at present. A purifier of the latest type, 16 feet by 12 feet, with luteless lid, has accordingly just been fixed by Messrs. Ashmore, Benson, Pease, and Co. Extensions of the water-mains have also been made to meet increased demands.

Manchester Corporation and the Chorlton Gas Supply.—Acting on behalf of the Manchester Gas Committee, the Chairman (Alderman Gibson) has written to the Directors of the Stretford Gas Company pointing out that a considerable number of householders in Chorlton-cum-Hardy whom the Company supply with gas have by amalgamation become citizens of Manchester, and will accordingly expect to be supplied with gas from their own city. He adds that he cannot for a moment think the Board will throw any difficulty in the way of the purchase of their rights and privileges in the district on reasonable terms; and he asks that the matter may be talked over in a friendly way before definite steps are taken.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Hydraulic Mains.

SIR,—I notice in your issue of the 3rd inst. a description of a patent applied for by Mr. G. F. Handel Beard, for sealing and unsealing hydraulic mains by means of a three-way valve that will allow the liquor from a tank to flow into the main, so as to raise the level of the liquid in the hydraulic main, or when the valve is reversed withdraws same and thereby unseals the dip-pipes. This is a very similar arrangement to that we have had in use for a considerable time at both our Litchurch and Cavendish Street works, and which has been seen by other engineers. A firm have supplied us with some four dozen three-way valves for this purpose. I do not suggest Mr. Beard's patent is a copy of my arrangement; it is another case of similarity of ideas.

Derby, Jan. 5, 1905. J. FERGUSON BELL.

SIR,—I notice in your last issue that you show drawings in connection with a patent (No. 2861) for a hydraulic main in which the seal can be put on and taken off at will. I should like to be allowed to point out that I consider this an infringement of my patent No. 19,706 of 1903, and also the fact that Messrs. R. & J. Dempster, with whom I believe Mr. G. F. Handel Beard is engaged, had my hydraulic main brought to their notice some time about August or September, 1903, when they made certain parts for me. If any reader refers to my specification and the claims therein, I think the similarities will be apparent.

Nuneaton, Jan. 4, 1905. GEO. HELPS.

Patents.

SIR,—This is a subject upon which Mr. Maurice Graham is (from his own accounts—judging by recent published statements) usually so well informed that it must be a great surprise to gas engineers when they note in your "Register of Patents" particulars of a new coal projector for which he has taken out a patent.

I must first of all say that it is not my intention, in thus writing, to emulate his recent praiseworthy object of "interesting" your readers, when he tried to confuse the issues in writing of my patent "dwarf" inclined retort-bench. I am less ambitious, and therefore confine myself to a plain unvarnished statement of facts—feeling, however, that most of these are sufficiently well known from the writing of "the moving finger" which has since "moved on" some considerable distance.

Flat-belt projectors have been in use for more than ten years on gold-dredgers, for getting rid of the tailings; and illustrations can be seen in the catalogue of the Robins Belt Company, showing material being projected.

About two years ago, I made drawings in which I tried to apply the principle to the projecting of coal into retorts. I found I had made a fool of myself, which—according to John Graham, in his "Letters of a Self-Made Merchant to his Son"—is not an uncommon occurrence. I found that Messrs. Gibbons Brothers had forestalled me (not in the fool-line, of course), by having already taken out a patent for such a flat-belt projector.

Following Mr. John Graham's advice, I have tried to so order things that I shall make a different sort of fool of myself next time. Judging by recent admissions, and the latest "patent," Mr. Maurice Graham does not strive for such originality.

Saltcoats, N.B., Jan. 7, 1905. ARCH. J. S. B. LITTLE.

LEGAL INTELLIGENCE.

Trade Marks Prosecution at Manchester.

Last Friday, the Manchester Stipendiary Magistrate had before him a case in which Mr. James Holland, trading as the British Gas Mantle Company, in that city, was summoned on three informations—first, for having applied a false trade description to certain incandescent gas-mantles; secondly, for having falsely described the place of origin of such mantles; and, lastly, for having sold and exposed for sale gas-mantles to which a false trade description had been applied. The complainant was Mr. G. C. Marks, the Patent Agent, acting under power of attorney for Mr. T. A. Edison; and the specific charge against the defendant related to the application by him of the name of the "Edison Mantle" to an incandescent mantle in which he traded, but in the production of which Mr. Edison had no interest whatever. Mr. Marks gave evidence as to a visit to the defendant's place of business. There was there a display of large and small bills referring to the "Edison Mantle." He bought a dozen for 2s., and ascertained from the defendant that he had a large stock. Having got the defendant's receipt, witness called his attention to the name "Edison" on the box, and informed him that he had no right to use it. The defendant said: "But the signature is 'Carl Edison.'" Asked who this erson was, he replied: "Of course, I am Carl Edison." Witness asked, "Why not call your mantle the 'Holland mantle'?" The defendant remarked: "Oh, Edison is a good selling name; if I called them the 'Holland' mantle, people would not buy them." The defendant maintained that he had a right to use the name "Carl Edison;" but he undertook to drop a letter in the surname and call his mantle the "Edson," which witness could not assent to. In the sale of mantles at the price stated, there was no fraud on the public. It was the application of the name that was objected to. On behalf the defendant, it was contended that if he undertook not to use the name any more justice would be satisfied by a nominal penalty. On the summons for applying a false trade description, the defendant was fined £5, and £5 5s. extra costs; all labels and bills in the defendant's possession bearing the name "Edison" (but not the mantles) to be forfeited.

MISCELLANEOUS NEWS.

NOTTINGHAM CORPORATION BILL.

The "Inspection and Control" Clause.

Some questions were asked at last week's Meeting of the Nottingham City Council with reference to the powers sought by the Gas Committee in the Corporation Bill now being promoted.

The Town Clerk (Sir Samuel Johnson) said the clause giving the Committee power of inspection and control did not apply to any old property, or any property unless the gas was put in for the first time, or if the whole gas service was altered. It only applied, too, to pipes covered up or built into the walls. Then the Committee would be empowered to make orders as to size, material, and strength of pipes which were covered up. Alderman Sir J. T. M'Craith: It only concerns work up to the meter. Am I right in that? The Town Clerk: No. It concerns work beyond the meter, where the service is new or where reconstruction is taking place. Alderman Sir J. T. M'Craith: I do not think the Committee understood that. We thought it only referred to the service between the main and the meter. Mr. Freeman: I understood we were asking for power to control the whole of the pipes buried. Mr. Harlow said what the Committee wanted was power to inspect all pipes put into new houses prior to their being covered up. The clause did not refer to the fittings from which the light was actually obtained. Alderman Fraser thought many people would have an objection to the inspectors coming into the houses and interfering with the arrangement of the gas-service. Mr. Harlow pointed out that the inspectors at present had power to enter the house of any consumer. The Committee, however, wanted power to inspect the service when the house was constructed, not after the tenant had entered, except when the entire arrangement was altered.

Alderman Sir J. T. M'Craith said he agreed with the application so far as the new buildings were concerned; but as the clause read at present, if anyone wished to make a renewal of pipes, his house was to be thrown open to the gas inspectors, and his arrangements altered according to their instructions. This was inquisitorial, and quite uncalled for. Sir John Turney remarked that they never heard of people going to the expense of taking out all the old gas-pipes from a house and putting in new, so they were discussing something by which practically no one would be affected. Mr. Skerritt suggested that a scale as to the size of the pipes, according to the number of the lights to be taken from them, should be drawn up. Alderman Sir J. T. M'Craith said he felt very strongly on the matter; and he moved that the clause be altered so as to refer to new buildings only.

This proposal having been seconded, Alderman Fraser asked why the clause should only refer to pipes which were covered up, and not to all gas-pipes in a house. In the smaller class of property, the pipes were usually exposed or simply covered with plaster or paper. To follow the matter logically, they should take power to supervise all the pipes and all the fittings; but this was going a long way. As it stood, however, the clause was illogical; and he doubted whether it would be effective. Mr. Green asked whether the powers would exceed those granted to the Electric Lighting Committee; and Mr. Harlow replied that they were similar to those possessed by that Committee. It was a matter that had been threshed out for many years; it was no "new-fangled" power they asked. Every gas committee in the country possessed it. As to Mr. Skerritt's suggestion, they would have power to adopt a scale as to the size of pipes to be used. They desired inspection of pipes that were buried only, because where pipes were exposed to view it was easy to detect a leakage or anything wrong. He asked that the clause should be passed as it stood. In reply to a question as to what was meant by "fittings," he explained that the elbows and tees were described as fittings. The inspection did not refer to pendants, &c.

Alderman Sir J. T. M'Craith's amendment that the powers be limited to the service between the main and the meter in regard to old buildings, and extended to the whole service in new buildings, was then put to the vote and defeated by 22 votes to 18. The promotion of the Bill was then agreed to.

LEICESTER CORPORATION GAS SUPPLY.

Another Record Year Promised—The Naphthalene Question—The Engineer and Outside Engagements.

At a Special Meeting of the Leicester Town Council held last Tuesday evening—the MAYOR (Mr. S. Hilton) in the chair—the progress made by the gas undertaking, the naphthalene question, and certain matters relating to the work of the Engineer (Mr. Alfred Colson) were under consideration.

Mr. JENNINGS, in the absence through illness of Mr. Edwards, the Chairman of the Gas Committee, moved the adoption of the report of the Gas and Electric Lighting Committee. He said the report was very short, but it was a pleasant one. They had been discussing ways and means that evening, and he was glad to say that he could promise a very handsome New Year's gift to the Council through the Gas Committee. Most of them would be aware that for a great number of years there had been a problem which had agitated the minds of gas engineers, and which he was glad to say had been solved ultimately by Leicester. At a previous meeting, the Chairman of the Gas Committee intimated that this discovery would save the Council something like £5000 a year. The Committee now generally knew that this was not an over-estimate, but rather an under-estimate. In May, 1904, Mr. Colson's invention for the extraction of naphthalene from gas was first put into operation. The result was that in the month of June they only had 68 cases, against 2705 in the corresponding month of the previous year. In July there were 15 cases, in August 19, in September 75, and in

October 139. All these were from the Belgrave works; and it was not till October that the invention was put into operation at the Belgrave works. They had only had during the seven months two cases outside the Belgrave works district. In November there were 48 cases, and in December only six, four of which were on the 1st and 2nd of the month. They might say now that, practically the thing was dead. The total number of cases during the seven months was 371, against 19,236 in the corresponding seven months of the previous year. The Council would easily understand that, in order to cope with these complaints, which sometimes numbered as many as 300 a day, they had to employ a small army of gas-fitters. They had not only been able to dispense with the services in this direction of a number of men, but they were saving money in other ways. They were able to get more gas out of the coal, and leave the coke in a better condition. He was very glad to say that although last year, with a profit of £38,000, was a record one, he thought he would be able to promise them that this year would show a greater profit still. With regard to the portion of the report having reference to allowing Mr. Colson to act as assessor under agreements for the valuation of tar on a sliding-scale, there had always been difficulties in the gas and chemical world when contracts were being arranged for the disposal of tar, in consequence of the ever-fluctuating values of the bye-products. When Mr. Colson was President of the Institution of Gas Engineers, he made a suggestion which went a long way towards the avoidance of these difficulties.

Alderman SMITH seconded the motion.

Mr. DAVIES moved that the words, "The Committee have also to report that hitherto Mr. Colson has acted as assessor under agreements for the valuation of tar on a sliding-scale, which position your Committee recommend he be permitted to retain," be not approved, and that the matter be deferred until after the consideration of the resolution on the *agenda* standing in the name of Mr. J. T. Biggs. The speaker argued that they ought not to grant to Mr. Colson privileges they would not grant to other officials.

Alderman WOOD said he thought it was understood by every member of the Committee that Mr. Colson was not to engage as Consulting Engineer to any corporation or gas company without the permission of the Council. He (Alderman Wood) told Mr. Colson that he hoped the motion of which Mr. Biggs had given notice would receive general approval by the Council, and that the principle would be established that no officer of the Corporation should take any outside work without the consent of the Council. Mr. Colson then asked how this would affect his invention for the removal of naphthalene. Would he be debarred from granting a licence to anyone who wanted to make use of the invention? Having pointed out that he informed Mr. Colson that he did not think he would be adversely affected in this connection, Alderman Wood said he thought the position of assessor under agreements for the valuation of tar was a privilege their Gas Engineer might be permitted to retain without any injustice to the town. He had done his best to urge Mr. Colson not to listen to the many invitations he had received since last September to move from Leicester.

Mr. BANTON seconded the amendment.

Mr. BIGGS thought it would be better to defer the matter.

Alderman SAWDAY supported the resolution.

Mr. CHAPLIN asked the mover and seconder to withdraw the amendment, seeing that the work the Labour men set themselves to carry out some time ago had been achieved.

Mr. DAVIES said he would withdraw his amendment provided Mr. Colson gave the fees he received to the common fund of the Council.

On being put, the amendment was lost by 39 votes to 6. The report of the Committee was then adopted.

SANDWICH CORPORATION GAS SUPPLY.

The Gas Committee and the Manager.

At the Meeting of the Sandwich Town Council on Tuesday last—the MAYOR (Mr. J. B. Joyce) in the chair—questions relating to the management of the gas-works came before the members.

At a meeting of the Council, as the Gas Committee, on Dec. 30 Mr. Belton, on behalf of a Sub-Committee specially appointed to inquire into the question of labour at the works, presented a report, recommending, among other things, the appointment of a working foreman in lieu of the present Manager (Mr. T. E. Pye), the abolition of outside work, and further alterations in regard to labour. These changes the Sub-Committee considered would tend to promote economy and efficiency. After discussion, the recommendations were adopted; and it was resolved that it be recommended to the Council to give a month's notice to the Manager, failing his resignation, and that if at the expiration of that time he had not obtained another appointment, the Council to take into consideration what arrangement could be made.

The business relating to the gas undertaking was opened by the reading of a letter which Mr. Pye had addressed to the Town Clerk (Mr. D. Baker), with a request that it should be read at the Council meeting. In the course of the letter, Mr. Pye said:

> Considering that this new Committee, charged by the ratepayers with the conduct of the gas undertaking, have already met many times, and yet, since their election early in November last year, have not once afforded me, the town's Gas Manager, any opportunity to confer with them on this or on any other important business of the undertaking, also considering that their present decision has been arrived at during my enforced absence from business through illness, it is only reasonable for me to request that, before I take so serious a step as resigning my appointment, I should be furnished with a copy of the report upon which the Committee's request is based, and that I should be given an opportunity of stating to the Committee my views upon that report. In the name, therefore, of that fair play which is the traditional right of all Britishers, I request that the whole matter be deferred, and that any action that may have been taken in connection with it be inoperative, until my side of this important question has been submitted to the Committee. I also request that an opportunity for this be arranged for at the earliest time convenient.

The MAYOR said he thought the report was based on economy; but he saw no objection, if the Council thought fit to do so, to hear Mr. Pye at their Friday meeting.

Alderman LASS proposed that Mr. Pye be given an opportunity of stating his case.

Mr. STOKES objected to any argument between the Council and a servant. The Committee had thoroughly discussed the matter, and he proposed that their recommendations be carried into effect.

Alderman HUGHES said one recommendation of the Sub-Committee was that, according to their view, it was necessary that a reduction should be made in regard to the cost of carrying on the gas-works, especially so far as the Manager was concerned. The report was altogether void of any personal remarks; and he, for one, was glad to find that it was so. There was no question the Sub-Committee considered that, although they might like to have a man of a certain calibre, as a matter of fact they could not possibly afford to do so; and, seeing the necessity of making a big reduction in the way of the working expenses, he did not hesitate to say that he was fully convinced that the views of the Sub-Committee were right. He therefore moved at the meeting that the Committee should adopt those views. He thought the result was that practically the whole Council voted for the recommendations. With reference to hearing Mr. Pye, there could be no harm in hearing what he had to say; but the great question in his mind was whether Mr. Pye was prepared to take the salary the Council could afford to pay. Then, of course, it would be for the Council to say whether he had, he would not say the practical knowledge, but the physical strength they required in a man to take the management of the works. They considered that their works were too small altogether—he believed this was the view of the Sub-Committee—to have a man simply as an overlooker. They wanted, as they had had before, a man who would take an active part, and, if necessary, be able to put his shoulder to the wheel and assist in carrying out the manual part of the work. These were the main reasons why the Sub-Committee came to their decision.

Mr. SCOTT, as a member of the Sub-Committee, said there was no mention whatever of Mr. Pye or his work. The question presented to the Sub-Committee was that which Alderman Hughes had explained. It was not a question of efficiency or inefficiency; they gave Mr. Pye credit for efficiency. So that he must distinctly understand that the object and motive actuating those delegated to carry out the inquiry were such as to do him justice as well as the undertaking. Therefore he (Mr. Scott) did not think there was any necessity for Mr. Pye to be heard, simply because there had been no reference whatever to him or to his working.

Mr. ROSE, another member of the Sub-Committee, said he was sure everyone on the Council was very sorry to cause the Gas Manager any discomfort or inconvenience. The only question was that the gas undertaking could not afford to be worked on the present lines, and this was why they came to the conclusion they had done.

The recommendations were then adopted *nem. con.*

Mr. PYE repeated his application for a hearing before the Committee.

The MAYOR said he thought it was not the wish of the Corporation that Mr. Pye should attend the meeting.

Alderman LASS said he would make a proposition that Mr. Pye be allowed to attend the meeting, and make a statement.

This proposal not being seconded, the Council passed on to the next business.

ASSESSMENT OF THE RADSTOCK GAS-WORKS.

At the Somerset Quarter Sessions, at Taunton, last Wednesday, before the Right Hon. J. W. Mellor, K.C., Mr. C. E. H. Chadwyck-Healey, K.C., and other Magistrates, an appeal was made by Earl Waldegrave against the assessment of his gas-works at Radstock by the Overseers of the Radstock Urban District Council. Mr. R. B. Vachell and Mr. E. H. C. Wethered appeared for the appellant; Mr. Ryde and Mr. F. E. Weatherly represented the respondents. Mr. Ryde said the appeal was against an assessment of £450 gross and £263 actual rateable value. After quoting numerous figures to show how the amount was arrived at, he remarked that his chief point was to ascertain the total quantity of gas made. There was so much difference between the appellant and themselves in this litigation at one time, that it was contended that the gas used in Lord Waldegrave's collieries should not be calculated, because the collieries were separately assessed; but this point had been recognized as absolutely untenable. Mr. Ryde then called Mr. J. H. Brown, the General Manager of the Nottingham Corporation Gas Department; Mr. D. E. Garlick, the Manager of the Glastonbury Corporation Gas-Works; and Mr. C. F. Jones, a Rating Surveyor, of London. For the appellant, evidence was given by Mr. J. E. J. M'Murtrie, the General Manager of the appellant's collieries and gas-works; Mr. C. Stafford Ellery, the Engineer and Manager of the Bath Gas Company; and Mr. Henry Woodall, of Westminster. Mr. Vachell said this was nothing more than an attempt to score a victory over a landlord. The Court, without calling upon Mr. Ryde, dismissed the appeal, with costs.

Fatal Gas Suffocation Case in London.—On Thursday afternoon, an aged couple named Hill, who lived at Holloway, were discovered dead in bed, under sad circumstances. Save for a lodger on the top floor, the couple lived alone; and on the day in question a niece, who lives some distance away, went to see her relatives. Knocking at the front door, she failed to get any response; and at length she entered by means of a key in her possession. Proceeding to the bedroom of Mr. and Mrs. Hill, she was surprised to find them in bed, apparently in a deep sleep. Then, noticing a strong smell of gas, she hurriedly sent for the doctor. Examination showed that both were dead, life having been extinct for from ten to twelve hours; and it transpired that gas was freely escaping from a chandelier in the room.

FATAL EXPLOSION AT THE BLOXHAM GAS-WORKS.

The Manager Killed.

The meter-house of the Bloxham (Oxfordshire) Gas-Works was last Monday week the scene of an explosion, by which the Manager, Mr. T. C. Betteridge, lost his life. The facts were fully explained in the course of the Coroner's inquiry, which took place on the following day; and widespread sympathy is felt with the wife and family of the deceased (who was 39 years of age, and had been at Bloxham since 1896) in the calamity which has befallen them.

On the day preceding the accident (Sunday), a meter which had been away for repair was fixed up again in the house; Mr. Thomas Burtonshaw (the father-in-law of deceased) coming over to Bloxham to superintend the work. The meter was put in position, and everything seemed satisfactory; but the gas was not turned into it that night, so that it was not properly tested. On the Monday afternoon, deceased, who had been filling the meter with water, told his wife that, as it leaked a little, they would have to take the end out again; and shortly afterwards he returned to her for a box of matches, which, however, she was unable to give him. He then left the house, and within a few minutes there was a loud report. Mr. Betteridge was subsequently found frightfully injured about the head; and a few hours later he expired.

Mrs. Betteridge, in her evidence, said that at first when she heard the report she thought it was someone shooting. She, however, went to the meter-house, and found her husband lying on the floor. George Woodward, who was at the time moving coal on the works, said he heard Mrs. Betteridge scream, and he ran to her. Having sent for medical assistance, he carried Mr. Betteridge (who was unconscious) to his house. He afterwards returned to the scene of the explosion, and saw that the meter was damaged and considerably displaced. Pieces of iron belonging to the meter were lying about the yard; and the building itself had also suffered.

Mr. Burtonshaw said the meter had been in use for some years, and was removed for the purpose of increasing the capacity of the inlet; the alteration was completed to his entire satisfaction. He made arrangements for the meter to be brought to Bloxham on the Sunday because he could not spare time on any other day. Witness and deceased, another son-in-law named George Carey, and a young man from the firm who had altered the meter, assisted in fixing it in position on the block where it formerly stood. His son-in-law was quite satisfied with the fixing; but the gas was not turned into the meter that night to see if there was any escape, so that it was not properly tested. He heard nothing more until he received a telegram at 4 o'clock on Monday. He went at once to Bloxham, and found his son-in-law was mortally injured. Witness went into the meter-house, and saw it considerably damaged; the front of the meter was blown out. He was fully convinced that the cause of the accident arose from Betteridge turning in the gas to test it; and he found the leakage that had been spoken of. He then shut off the gas again, as he thought, but it was not shut completely off; and therefore there was an escape of gas into the meter from the inlet at the back. The gas then escaped from the meter into the house. Deceased must have lighted a match; and, of course, the explosion followed. He had not removed the plate in front before he lighted the match, which undoubtedly caused the explosion. Witness believed he struck the match immediately he opened the meter-house door. (Two matches were produced which had been struck and burnt.) It was a great act of indiscretion on the part of the deceased; and his death was caused by this indiscretion. Witness added that he took full responsibility in the matter of the repair of the meter.

Medical evidence of the injuries sustained by deceased was given; Dr. Schofield stating his belief that a portion of a plate blown from the meter struck deceased's forehead. The Coroner then summed up (remarking that he could not see that anyone was to blame except deceased himself), and the Jury returned a verdict of "Accidental death."

Mr. E. L. Fisher, the Managing-Director of the Gas Company, said he wished to express the deep regret of the Company at the terrible calamity. He, personally, had known the deceased perhaps more than any of the other Directors, because he had met him so often during the past nine years. He looked upon him more as a personal friend than an employee. He deeply regretted the sad affair, and lamented the loss of the deceased, as he was sure all did who knew him.

FIRE AND EXPLOSION AT THE PADIHAM GAS-WORKS.

In the early hours of Sunday morning, considerable alarm was caused in Padiham by a loud explosion at the gas-works, which it subsequently transpired was of a serious character. Shortly before midnight on Saturday a fire was discovered in the governor-room, which is part of a square building two storeys high, which includes store-rooms, offices, and a fire-brigade station. When the firemen arrived, the building was well alight; the flames evidently being fed by an escape of gas. Any attempt to reach the governor-room before the fire had been subdued was, however, out of the question. In about an hour, the fire was overcome; but while the men were still playing on the building, an explosion took place which was heard several miles away. A shed on which several firemen were standing was blown down, and three of them were injured; while numbers of windows in the vicinity were smashed. In all there were five men injured—the firemen already mentioned and a stoker and a labourer employed on the works, who were knocked down by the force of the explosion. They were, however, after medical attention, able to walk home.

All the gas in store escaped, and the town was consequently in darkness for the remainder of the night; but a supply was available for the following night. A large crowd was watching the fire; but on hearing the explosion the people fled panic-stricken in all directions. The occupants of adjacent houses left their homes; and scores of families took refuge for the night in other parts of the town. The customary rumour got abroad that the gasholder itself would explode; and many persons were unnecessarily alarmed. The fire was confined to the governor-room and the store-room above; but considerable damage was done to the whole building by the explosion—the windows being smashed and the walls forced outwards. Fortunately, the retort-house and the gasholder, which are much nearer the governor-room than most of the damaged houses and shops, were not disturbed at all. It is estimated that the damage will exceed £1000.

PRICE OF GAS AT DONCASTER.

A proposal of the Doncaster Gas Committee to reduce the price from 2s. 6d. to 2s. 4d. per 1000 cubic feet, was unfavourably regarded by so many of the councillors that it was defeated by the Council in committee by the casting vote of the Mayor. This, however, did not finally settle the matter, for at last week's meeting of the Council Alderman Wainwright, the Chairman of the Gas Committee, moved the non-confirmation of the minute of the Council in committee rejecting the proposal of the Gas Committee. He said he did so, first, because the passing of such a resolution was unusual; in the second place, because it was unnecessary; and, in the third place, because it was unwise. It was unusual to put on the minutes of the Corporation a record of an alteration which had not been made. The Gas Committee could not reduce the price of gas unless it was sanctioned by the Council; and therefore the resolution was unnecessary. Then it was unwise to tie the hands of the Committee. It was estimated that the change proposed would reduce the revenue from the gas-works by £1330. Towards this they had during the past year saved in the price of coal £525; and they had also saved by the introduction of more modern machinery £600. But they did not suppose for a moment that the whole of the £1330 would be lost; they hoped that they would increase their output and make a greater profit.

In seconding the amendment, Mr. Armitage remarked that he could go back to the time when, fourteen years ago, they were charging 2s. 11d. per 1000 cubic feet. It was considered an abominable price; and they reduced it to 2s. 6d., at which figure it had remained ever since. The gas-works had been a very handsome profit-paying department for many years. If the public knew what gas cost to produce, they would be astonished. Mr. Ellis opposed the proposed reduction on the ground that the gas-works were the property of the borough, and they ought not to be called upon to be the relieving officers for the outside districts. They could not get over the fact that they were going to lose £1330 if they adopted the suggestion. Mr. Kay, in supporting the reduction, pointed out that last year they made a profit on the supply of gas of £4000, in 1903 of £2000, in 1902 of £2613, and in 1901 of £2020.

After some further discussion, a vote was taken, when there were for the reduction 11, and against 10. Some difficulty arose as to a point of order; but it was understood that the minute would go back to the Committee, and the alteration would not take effect until March 31.

GAS SUPPLY IN THE DUKINFIELD DISTRICT.

Messrs. Moss and Barker, of Ashton-under-Lyne, have compiled a comparative statement of working and other expenses, extracted from the balance-sheets of the Ashton-under-Lyne, Denton, Dukinfield, Hyde, Mossley, and Stalybridge gas undertakings, for the years ending respectively in December, 1903 (Hyde), and in March and June, 1904. The quantity of gas accounted for in the periods named was as follows: Asnton, 310,215,316 cubic feet; Denton, 73,304,493 cubic feet; Dukinfield, 77,395,000 cubic feet; Hyde, 135,906,400 cubic feet; Mossley, 97,412,000 cubic feet; and Stalybridge, 152,387,300 cubic feet. The items in the table are worked out on the basis of the gas accounted for; but the compilers point out that in some cases the gas consumed on the works and in the offices is included, whereas in others it is not. The figures may not, therefore, be strictly comparative so far as this is concerned. The following figures show the total cost of production in the towns named: Ashton, 2s. 1·22d.; Denton, 2s. 1·78d.; Dukinfield, 2s. 5·16d.; Hyde, 2s. 5·49d.; Mossley, 2s. 8·17d.; and Stalybridge, 1s. 9·15d. The average price of gas was: Ashton, 2s. 3·95d.; Denton, 2s. 5·83d.; Dukinfield, 2s. 9·72d.; Hyde, 2s. 8·08d.; Mossley, 3s. 0·59d.; Stalybridge, 2s. 4·12d. The profit realized per 1000 cubic feet in the six towns was therefore (taking them in the order named): 2·73d, 4·05d., 4·56d., 2·59d., 4·42d., 6·97d. In a table compiled by Mr. Harrison Veevers, the Gas Engineer, Manager, and Secretary to the Dukinfield Corporation, which is printed under that of Messrs. Moss and Barker, the cost of production, the capital charges, the income from residuals, &c., are worked out for the towns named on the basis of each 1000 cubic feet of gas sold. He gives the net cost, exclusive of capital charges, as follows; Ashton, 1s. 6·98d.; Denton, 1s. 2·4d.; Dukinfield, 1s. 6·81d.; Hyde, 1s. 7·31d.; Mossley, 1s. 11·44d.; and Stalybridge, 1s. 1·4d.—the capital charges being respectively 6·24d., 11·38d., 10·35d., 10·18d., 8·73d., and 7·75d.

Failure of the Electric Light at Southport.—Consternation was caused at the New Year's evening service at Holy Trinity Church, Southport. When the vicar was half way through the final prayer, the electric light failed, and the church was plunged in darkness. Gas-jets had to be lit; but before this could be done, there was an awkward pause, and the prayer was concluded in darkness. After the gas had been in use for some little time, the electric light was restored.

Price of Gas to Slot Consumers at Stockport.—In reply to an inquiry, Alderman Clarke, the Chairman of the Stockport Gas Committee, stated at the last meeting of the Town Council that it was hoped a discount would be allowed to prepayment consumers when the question came up at the end of the present financial year. He pointed out that during December the receipts from the slot meters amounted to £1397, or practically £300 a week, and that the revenue from this source was increasing.

INCANDESCENT GAS LIGHTING AT BATH.

After long deliberation, the Surveying Committee of the Bath Town Council have decided upon the adoption of incandescent gas lighting for the streets of the city. The Street Lighting Committee, who recommended some time ago that this system of lighting should be carried out, presented a report in which they said they had again considered the matter, and, with a view to providing for the maximum efficiency in the lighting of the thoroughfares and courts with the minimum increase in cost, they again recommended that the existing flat-flame burners should be discarded, and incandescent burners substituted. On comparison of several burners, they concluded that "C" No. 14 was best adapted to the purposes of the city. By its use the expense of new cradles and lanterns, which would be necessary for Kern burners, would be avoided; while the use of a chimney would protect the mantles, and the small reflector used in the lanterns intensified the light, so that it appeared equal, if not superior, to the light given by the Kern or other burners. The Gas Company offered to change the existing flat-flame burners for incandescents of "C" No. 14 pattern free of cost to the Corporation, and charge a uniform rate of £2 11s. 5d. per lamp per annum, which was 8d. per lamp less than was now being paid for the incandescent lamps in use. To change the whole of the lamps would involve an extra cost of £420 10s. 4d. per annum for lighting; and the Committee recommended that, as a beginning, instructions be given for the alteration of the 179 4-feet lamps in the city district, which would entail an annual increase of £58 in the cost of lighting. The Committee were of opinion that the result would prove so satisfactory as to lead to a further extension of the system in the near future. The cost of lighting by incandescent burners had been reduced year by year from £3 11s. 11d. per lamp in 1900 to £2 12s. 1d. in 1904 and the present offer of £2 11s. 5d. The cost of lighting by flat-flame 4-feet burners was £2 5s. per lamp per annum. Some members of the Surveying Committee suggested that the matter should be further postponed, or that incandescent lighting should not be made general because of the permanent addition which it meant to the rates. The report was, however, adopted.

TORQUAY ELECTRICITY SUPPLY.

The Gas Company Ask for the Northumberland Clause.

An inquiry was held at Torquay last Wednesday, by Mr. H. Ross Hooper, M.Inst.C.E., one of the Inspectors of the Local Government Board, with reference to the application of the Corporation for power to borrow £42,000 for electricity works. As already explained in the "JOURNAL," these works have outgrown the original site, and in order to provide for the future demand, and particularly with the object of supplying current for tramways which are to be laid by a Company, it is proposed to build new works elsewhere. The Town Clerk stated that the number of private customers of the department had increased from 55 in 1898, when the works were started, to upwards of 400, and the revenue had grown from £1800 to £6700 a year. Mr. S. H. Easterbrook attended the inquiry on behalf of the Torquay Gas Company, who were also represented by the Chairman (Mr. J. Kitson) and the Manager (Mr. R. Beynon). Mr. Easterbrook drew the Inspector's attention to the finances of the Corporation with regard to their electric light undertaking, and said that if the increased capital expenditure was allowed there was a likelihood of there being a deficit on the working. In view of this, he asked that the Local Government Board should make their sanction of the loan conditional upon the Corporation giving an undertaking to carry on the works under the Northumberland clause, and that when they applied for extended powers they should include provisions similar to those contained in that clause. The Inspector pointed out that he had to inquire into the scheme upon its merits, and not in regard to any conditions. Mr. Easterbrook said the sum asked for was an extraordinary amount, and the case was, he submitted, one in which the Local Government Board might very properly make their sanction conditional. The effect of the Northumberland clause was that the rates for electric lighting would be revised every three or four years, so that no loss should be incurred by the general body of ratepayers in respect of the undertaking. If Parliament gave power to the Corporation to charge a maximum of 8d. per unit, it was common sense to say that they intended this maximum should be reached before the Corporation sought to charge the deficit to those who did not use electricity. The Town Clerk characterized this demand as unprecedented so far as applications to the Local Government Board were concerned. Applications with regard to conditions were only usual in the case of Provisional Orders. Moreover, it was without justification. Since the working of the electric light undertaking was begun, the Corporation had been able to meet their liabilities, and, in addition, had put £300 to a reserve fund; and they would take care to so watch the progress of the concern as to prevent any deficit occurring. He asked that Torquay should not be put under the conditions mentioned. Evidence having been given with reference to the proposed works, the inquiry was adjourned in order that certain financial information might be prepared.

Price of Gas at Middlesbrough.—The Gas Committee of the Middlesbrough Corporation have reported to the Town Council that to make a scale of charges for large consumers which would give any substantial reduction would mean, in their opinion, a very serious reduction of revenue; and they see no prospect of obtaining sufficient new business to compensate for this. They therefore recommend to the Town Council that no sliding-scale should be adopted, but that in the next financial year the price of gas should be substantially reduced to all consumers.

Bilston Gas Company.—The annual meeting of this Company was held on Monday last week; Mr. H. Holcroft in the chair. The Secretary and Manager (Mr. J. S. Reeves) having presented the report and accounts, which were noticed in the "JOURNAL" for the 27th ult., the Chairman moved their adoption. In doing so, he remarked that, by careful management, the Company had been able to keep down the price of gas, notwithstanding the cost of coal and the considerable burden of local taxation. With the view of maintaining their works in a thorough state of efficiency, they had requested Mr. R. O. Paterson, of Cheltenham, to inspect them; and his report was quite satisfactory. The motion was carried, and the dividends recommended by the Directors were declared.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 84.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
530,000	10	Oct. 13	10½	Alliance & Dublin 10 p.c.	20½—21½	..	4 17 8
100,000	10	,,	7½	Do. 7 p.c.	14—15	..	*5 0 0
200,000	5	Nov. 11	6½	Bombay, Ltd.. . .	6—6½	..	5 0 0
140,000	5	,,	6½	Do. New, £4 paid	4½—5	..	5 4 0
50,000	10	Aug. 31	14	Bourne- 10 p.c.	29—30	..	*4 13 4
251,810	10	,,	7	mouth Gas B 7 p.c.	16—17	+½	4 2 4
53,200	10	,,	6	and Water Pref. 6 p.c.	14½—15½	..	3 17 5
380,000	Stk.	Aug. 12	12	Brentford Consolidated	250—255	..	4 14 1
300,000	,,	,,	9	Do. New . . .	190—195	..	4 12 4
50,000	,,	,,	5	Do. 5 p.c. Pref. .	130—135	..	3 14 1
206,250	,,	Dec. 15	4	Do. 4 p.c. Deb. .	105—108	..	3 14 1
220,000	Stk.	Sept. 15	11	Brighton & Hove Orig.	227—232	..	4 14 10
246,320	,,	,,	8	Do. A. Ord. Stk. .	167—172	..	4 11 0
460,000	20	Sept. 29	10	British	40½—41½	..	4 16 5
100,000	Stk.	Aug. 12	6	Bromley, Ord. 5 p.c. .	117—122	..	4 18 4
165,700	,,	,,	4½	Do. do. 3½ p.c. .	92—95	..	4 13 9
500,000	10	Oct. 13	7	Buenos Ayres (New) Ltd.	11½—11⅝	..	5 19 2
250,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb. .	93—95*	..	4 4 3
150,000	20	July 14	8½	Cagliari, Ltd.	24—26	..	6 6 11
100,000	10	Sept. 29	10	Cape Town & Dis., Ltd.	16½—16¾	+⅜	5 19 5
100,000	10	Oct. 27	4½	Do. 4½ p c Pref . .	9½—9⅝	..	4 12 4
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	51—53	..	5 13 2
50,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	100—102*	..	4 8 3
1,375,000	Stk.	Aug. 31	5⅜	Commercial 4 p.c Stk. .	117—120	..	4 6 8
560,000	,,	,,	5	Do. 3½ p.c. do. .	113—116	..	4 6 2
450,000	,,	Dec. 15	3	Do. 3 p.c. Deb. Stk.	85—87	..	3 9 0
800,000	Stk.	,,	6½	Continental Union, Ltd.	116—119	+2	5 9 3
200,000	,,	,,	7	Do. 7 p c. Pref.	140—145	..	4 16 7
486,090	10	July 14	11	European, Ltd. . . .	20½—21½	..	5 2 4
354,060	10	,,	11	Do. £7 10s. paid	14—15	..	5 10 0
15,243,200	Stk.	Aug. 12	4⅛	Gas- 4 p.c. Ord. . .	101½—102½	−1½	4 5 10
2,600,000	,,	,,	3½	light 3½ p.c. max. . .	93—95	+1	3 13 8
3,799,735	,,	,,	4	and 4 p.c. Con. Pref.	103—111	..	3 12 1
4,193,975	,,	Dec. 15	3	Coke 3 p.c Con. Deb.	87—89	+1	3 7 5
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.	100—103	..	4 17 1
70,000	10	Sept. 29	11	Hongkong & China, Ltd.	16—17	..	6 9 5
3,800,000	Stk.	Nov. 11	10	Imperial Continental .	211—213	+1	4 13 11
473,600	Stk.	Aug. 12	3½	Do. 3½ p.c. Deb. Red.	96—98	..	3 11 4
175,036	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c. .	118—123	..	4 17 7
561,000	Stk.	Aug. 31	10	Liverpool United A . .	222—224	+3	4 9 3
718,100	,,	,,	7	Do. do. B .	160—162	..	4 6 5
306,083	,,	Dec. 30	4	Do. do. Deb. Stk.	105—108*	..	3 14 1
75,000	5	Dec. 15	5	Malta & Medn., Ltd. .	4—4½	..	5 11 1
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb..	102—104	..	4 16 2
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	Nov. 11	3½	Monte Video, Ltd. . .	10—11	..	6 7 3
1,515,892	Stk.	July 29	4½	Newc'tle & G'tesh'd Con.	109—110	..	4 1 10
406,025	Stk	Dec. 30	3¾	Do. 3¾ p.c. Deb.	90—91*	..	3 16 11
15,000	10	Aug. 31	10	North Middlesex 10 p.c.	19½—20½	..	4 17 7
52,940	1	,,	7	Do. 7 p.c.	13½—14½	..	4 16 7
300,000	Stk.	Nov. 30	8	Oriental, Ltd. . . .	147—150	..	5 6 8
600,000	5	Sept. 15	7	Ottoman, Ltd. . .	5½—6½	..	5 12 0
235,005	Stk.	—	6½	Plym'th & St'house 5 p.c.	—	..	—
398,490	5	Apl. 28	5	Primitiva Ord. . . .	5⅛—5⅜	..	4 6 11
796,980	5	July 28	5	Do. 5 p.c. Pref. .	4⅞—5⅛	..	4 15 3
488,900	100	Dec. 1	4	Do. 4 p.c. Deb. .	93—95	..	4 4 3
851,070	10	Oct. 13	7	River Plate Ord. . . .	11⅝—1 1/16	..	5 14 3
300,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb. .	94—96*	..	4 3 4
250,000	10	Sept. 15	6	San Paulo, Ltd. . . .	12—12½	..	4 16 0
70,000	50	Jan. 3	5	Do. 5 p.c. Deb. .	52—54*	..	4 12 7
135,000	Stk.	Sept. 15	10	Sheffield A	238—240	..	4 3 4
209,984	,,	,,	10	Do. B	237—239	..	4 3 8
523,498	,,	,,	10	Do. C	236—238	..	4 4 0
123,998	Stk.	Sept. 29	5	Shrewsbury Ord. 5 p.c.	104½—107½	..	4 13 0
70,000	10	,,	11	South African	16—17	..	6 9 5
6,250,000	Stk.	Aug. 12	5½	South Met., 4 p.c. Ord.	132—134	..	4 2 1
1,832,700	,,	July 14	3	Do. 3 p.c. Deb.	89—91	..	3 5 11
575,000	Stk.	Aug. 31	5½	S'th Suburb'n Ord. 5 p.c.	123—126	..	4 7 4
60,000	,,	,,	5	Do. 5 p.c. Pref. . .	125—130	..	3 16 11
112,533	,,	July 14	5	Do. 5 p.c. Deb. Stk.	133—138	..	3 12 6
502,310	Stk.	Nov. 11	5	Southampton Ord. . .	105—107	..	4 13 6
87,950	,,	—	4	Do. 4 p.c. Deb.	—	..	—
120,000	Stk.	Aug. 31	6¾	Tottenham A 5 p.c. .	123—128	..	4 17 8
325,520	,,	,,	4¾	and B 3½ p.c. .	95—100	..	4 15 0
115,000	,,	Dec. 15	4	Edmonton 4 p.c. Deb.	102—105	..	3 16 2
182,380	10	,,	8	Tuscan, Ltd.	8¾—9¼	..	8 13 0
149,900	10	Jan. 3	5	Do. 5 p.c. Deb. Red.	94—96*	..	5 4 2
30,000	Stk.	Aug. 31	7¾	Wands- A 5 p.c. . .	160—165	..	4 13 11
255,636	,,	,,	6¼	worth B 3½ p.c. . .	133—138	+3	4 10 7
51,293	,,	,,	5⅛	and C 3½ p.c. . .	110—115	..	4 13 6
57,564	,,	Dec. 30	3	Putney 3 p.c. Deb. Stk.	77—82*	..	5 13 2
745,872	,,	Aug. 12	5	West Ham 5 p.c. Ord. .	100—102	..	4 18 0
85,000	,,	,,	5	Do. 5 p.c. Pref. . .	122—127	..	3 18 9
160,000	,,	Dec. 30	4	Do. 4 p.c. Deb. Stk.	101—106*	..	3 15 6

Prices marked * are Ex div.

RIVINGTON WATER ARBITRATION.

The Award to be Contested.

At the Meeting of the Liverpool City Council last Wednesday—the Lord Mayor (the Right Hon. John Lea) presiding—the presentation of the minutes of the Water Committee, which contained a recommendation to the Council to dispute the award of Mr. R. E. Middleton in the arbitration between the Corporation and Mr. Lever in regard to his Rivington Estate, gave rise to considerable discussion. The recommendation was opposed by Sir Charles Petrie.

The first matter which engaged attention was an item of expenditure in connection with the arbitration, for which, it was urged, there was not adequate explanation. The Chairman of the Committee (Alderman Burgess) said it was an account paid for services rendered by a doctor who attended the Umpire during the time he was at Rivington, and to another medical man who was called in consultation. In connection with this matter, a report addressed to the Town Clerk by Dr. T. R. Glynn was read, in which it was shown that at the time of Mr. Middleton's inspection of the Rivington watershed last July he was suffering from a serious breakdown in health. Alderman Burgess explained that Dr. Glynn went over to Rivington to see Mr. Middleton at the request of the Water Engineer, and that the Town Clerk had asked him to state his opinion as to the condition in which he found him. The Town Clerk acknowledged that he had asked for the report; his reason for so doing being to assist the Corporation, if necessary, in any defence they might make to the action brought against them. He added that the report had been issued at the time the award was made. Mr. Taggart expressed the opinion that the Town Clerk had very greatly exceeded his duty. The Town Clerk said he was instructed to take such steps as he thought advisable in order to defend the action. He thought it his duty to get his evidence ready; and the report read was part of it. He was not going to advise the Council to depend upon it as a defence to the action; in fact, he did not think they could upset the award merely on the report. He had advised the Committee to this effect; and the Committee had been advised by Counsel. He thought the Council were entitled to know this. Sir Charles Petrie said he had never heard anything of the report before that day; and therefore he ought, perhaps, under the circumstances, to withdraw his notice of opposition. On the appeal of the Lord Mayor, the Council passed the proceedings of the Committee, except the part opposed by Sir Charles.

This matter having been disposed of, Alderman Burgess said the particular item that was objected to was a resolution passed by the Water Committee on the 6th of December, to the effect that the Town Clerk be instructed to defend any proceedings to enforce awards, or to take steps to set aside awards, should it be advisable to do so. These awards were the one in the arbitration between the Corporation and Lever and two others which related to part of the same property. The Corporation, desiring to protect the purity of the water, obtained the sanction of Parliament to buy the whole of the Rivington watershed, with the exception of the park presented by Mr. Lever to Bolton, his bungalow, and a small piece of ground at Rivington Pike. He (Alderman Burgess) was not saying a word against the course Mr. Lever had thought it proper to take. He had acted within his rights in all that he had done; and so far as he (the speaker) was concerned, he had never made any reflection whatever upon him. But the Water Committee were face to face with this fact—that for the whole of the property, which he bought three or four years ago, he paid £60,000. He paid that money at a time when there was competition for the property—when it was known to the vendors that there were two likely buyers for the whole of it; and yet for one portion of it only, and that not such good land as had been set aside for the park, the enormous amount of £138,000 had been awarded. He confessed that when he saw the award he was staggered by it. They had had valuations ranging from £26,000 to £35,000, and they made Mr. Lever what they considered a fair and substantial offer for the property; but he did not see his way to accept it. The award that had been made was of such a character that the Water Committee came to the conclusion that they could only see their way to paying the money if they were forced to do so. They thought they ought to defend any action that might be brought, and endeavour, if possible, to have such an extraordinary award set aside. They considered that the amount was altogether out of proportion to everything else awarded on the whole of this watershed; and he personally was quite certain there was not a man living who would have given £50,000 for that for which £138,000 had been awarded.

In opening the discussion, Mr. W. W. Rutherford, M.P., said he thought the Council should go on opposing the award, with the view of eliciting the facts and understanding what were the true interests of the city. Mr. Taggart proposed an amendment to the effect that the recommendation of the Committee be not confirmed, and that the Town Clerk be instructed not to defend the action. He argued that there was no precedent for attempting to upset an award of this kind, and deprecated the Council adopting a policy which might involve them in an enormous sum in costs. Mr. Muspratt, in seconding the amendment, contended that no sufficient reason had been given why the award should be opposed. Mr. H. Miles urged that, having made a bad bargain, the Corporation should pay up, and maintain the good credit of the town. Mr. J. T. Wood remarked that if the award in Mr. Lever's case was right and just, the Council and the Umpires who had acted in all the other cases in the watershed had robbed the various owners of not less than £150,000. In other words, if the award was right, they had paid £150,000 too little for the properties they had purchased outside Mr. Lever's. On these grounds, he hoped the Council would allow the Committee to proceed. Sir Charles Petrie remarked that he entered the Council chamber prepared to recommend the acceptance of the award. However, matters had transpired which led him to the conclusion that the Water Committee knew a great deal more about the matter than the ordinary members of the Council. The ratepayers of Liverpool ought to know exactly how things stood; and it was the

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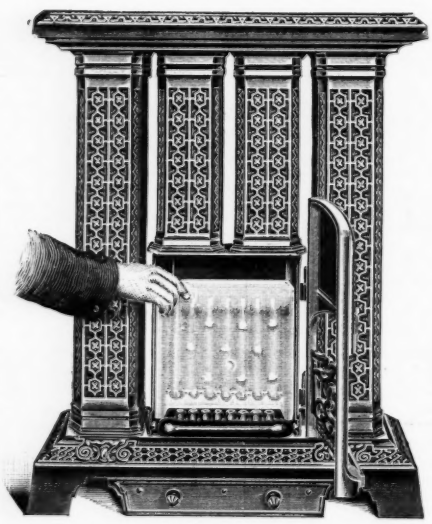

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duty of the Council to accept the advice of the Committee, and take their chance in the Courts.

After some further remarks, Mr. Taggart, with the consent of Mr. Muspratt, said he would withdraw the amendment. As there was some objection to this, the Lord Mayor took a show of hands, and there was a large majority in favour of the withdrawal of the amendment. Sir R. Hampson said that, to be in order, the recommendation of the Water Committee should be put. The Lord Mayor was proceeding to submit it, when there was some interruption. Mr. Patterson moved an amendment that the question be referred back to the Water Committee for further consideration before they embarked on litigation. On being put, however, this was defeated by 65 votes to 20. A division was then challenged on the Committee's recommendation, with the result that it was adopted by 48 votes to 7.

PLYMOUTH CORPORATION WATER SUPPLY.

A Report on Four Years' Work.

The Water Engineer to the Plymouth Corporation (Mr. Frank Howarth, Assoc.M.Inst.C.E) has presented a report on the work of his department for the four years ended March last. During this period there was a continued steady advance in the income, due partly to new supplies and partly to a revision of the charges. Up to March, 1902, supplies by meter were charged at the rate of 2d. per 1000 gallons inside the borough, and 3d. per 1000 gallons outside; the minimum charge being 15s. 9d. per quarter for 94,500 gallons in the former case, and £2 7s. 3d. per quarter, for 189,000 gallons, in the latter. In addition, water was supplied free of charge, or at a nominal figure, to municipal departments, schools, and other institutions. This practice was revised; free supplies being discontinued, and the prices for services by meter being raised to 3½d. per 1000 gallons within, and 6d. per 1000 gallons beyond, the borough; while at the same time the minimum was reduced to 5s. per quarter for 17,000 gallons in the former, and £1 for 40,000 gallons in the latter case. It was estimated that the result of these changes would be an additional revenue of £2400; but in the year 1902-3 the actual increase for meter supplies was £3143, of which £2842 was due to the revision of the charges. Including meter-rents, the net increase in the income from meter supplies was £2816 in 1902-3, and £294 in 1903-4; the consumption in the former year showing an increase of 29,252,000 gallons, and in the latter year 1,413,000 gallons.

The average population of the district served is 139,575; and in 1904 the daily supply was 5,839,000 gallons, or 41·83 gallons per head. In the two preceding years it was 45·77 gallons and 46·43 gallons respectively. A small part of the substantial reduction during the last twelve months may be attributed to the wet summer of 1903; but that the greater part was due to the checking of waste was shown by the registration of the district meters during the hours between midnight and 4 a.m. This, though it showed a reduction of 3½ gallons per head, still worked out at 15·07 gallons per head for the 24 hours. The statistics with regard to inspections and the defects discovered led to the conclusion that taps of inferior make and finish have been, and are still being, fixed in the district. The number of burst lead pipes was very large; while in many instances these pipes are too large for the requirements of the consumer; those of ¾ inch diameter having been laid where ⅝ inch would be ample. The regulations in force are being revised with a view to making them more explicit and more stringent; but the preparation of them is being delayed until the Joint Committee on Water Regulations (to which reference was made in the "JOURNAL" for the 20th ult.) has decided on standard clauses and standard fittings to suit the varying pressures and conditions of different towns. Mr. Howarth proceeds to point out that the question of waste has an important bearing on future capital expenditure, and says that if the population continues to increase at the present rate, the storage reservoir at Burrator will suffice for only eighteen years, if the consumption remains at 42 gallons per head. When the reservoir was designed, it was anticipated that 35 gallons per head would be ample; and at this rate the storage would be enough for upwards of thirty years. The total length of mains is 123 miles 1468 yards. Of these, 58 miles consist of extensions since January, 1890; 14 miles 679 yards having been laid in the last four years.

For the year ending March, 1904, the income of the undertaking was £30,176, compared with £28,262 in the previous year. The maintenance and management charges amounted to £10,497, compared with £9895. The gross profit was £19,678, against £18,366; and the interest, sinking fund, and income-tax charges were £15,182, against £13,564. The net profit was £4495, compared with £4801 in 1903. Between 1895 and 1904, net profits amounting in the aggregate to £32,701 were appropriated in relief of the rates. In addition, the amount paid to the town rates by the water undertaking has been considerable, and for the year 1904 was £1669. The average price received for all the water supplied in the district was 3·10d. per 1000 gallons, which Mr. Howarth says will be found as low as any, if not the lowest, of the large water undertakings in England.

TORQUAY CORPORATION WATER SUPPLY.

The Increased Cost of the Works.

Reports were presented to the Torquay Town Council last Tuesday, by Mr. S. C. Chapman, the Water Engineer to the Corporation, Mr. G. R. Strachan, the Consulting Engineer, and Mr. F. S. Hex, the Town Clerk, with reference to the cost of the new reservoir which is being constructed at Trenchford. Mr. Chapman's report, which was the most elaborate, set forth that the parliamentary estimate of the cost of the works was £22,000, made up as follows: Works, £21,238; land, 7½ acres, £262; Bill (unopposed), £500. Against these amounts there

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had been spent £11,911 on works; £2066 on 14½ acres of land (being £1804 in excess of the estimate); and £3212 on the Bill, or £2712 in excess, this being due to opposition. The purchase of the extra quantity of land was wise and prudent. In regard to the cost of the works, the estimate would be considerably exceeded. In the trial pits sunk at six points along the line of the dam, rock was found at an average depth of 13 ft. 6 in.; but, unfortunately, these pits gave no true indication of the character of the ground throughout the whole length of the trench. The depth reached at the end of November averaged about 32 feet; and it had been necessary to carry the excavations much farther into the sides of the hill than was originally intended. Throughout the rock has had many joints, and in several spots the granite was quite decomposed. As they went deeper there was a marked improvement in the character of the rock, and it would not, he thought, be necessary to undertake any further great amount of excavations; but that which had to be done would be very expensive. In the original estimate, it was assumed that there would be but little timbering or pumping necessary; but the very opposite was the case. It was also hoped that suitable clay would be found on their own land; but none fit for use had been discovered, and it would have to be hauled from the Teign Valley. Provided the excavation did not exceed the quantity he anticipated, the works would be finished for £37,410, less the value of the plant and sundry credits, estimated at £2610, or a total of £34,800 for the works alone; being an increase over the estimate of £13,562. An additional sum of £1500 should be added for settling-ponds at the stream inlets, and for an alteration at a draw-off at the Tottiford reservoir.

Mr. Strachan, in the course of his report, expressed the opinion that a good bottom was not far off. He said that in trench bottoms a time came when soundness and tightness had to be risked; but it was not yet possible to take the grave chances of leakage which the present bottom suggested. The Town Clerk's report referred to the cost of the opposition. He stated that for the completion of the works it would be necessary to apply to the Local Government Board for sanction to borrow the further sum of £17,500. Alderman Bovey, the Chairman of the Water Committee, moved that application should be made for the additional loan; and said that while they were all disappointed at the excess in the expenditure, it was owing to contingencies which could not be foreseen. There was nothing to do but to go forward and bring the works to a successful completion. The motion was agreed to.

Extensions by the Southport Water Board.—The Southport, Birkdale, and West Lancashire Joint Water Board have decided on carrying out a series of extensions at their works at Springfield, one of which is a new winding-shaft and northerly heading. The estimated cost of the shaft is £2000; and Mr. Henry Rofe, M.Inst.C.E., the Consulting Engineer to the Board, has been authorized to proceed with the work, which is to be executed by contract, after tenders have been submitted.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The members of the Eastern District of the Scottish Junior Gas Association held their first technical meeting this afternoon; and I think that anyone reading the proceedings, a report of which appears on another page, will agree that they have given a good account of themselves. As I said, however, of the last meeting of the Western District, so I say again, the authors of papers err in endeavouring to cover too wide a field. If one or two members who are favoured to appear before the Association in its early days cover the whole field of gas manufacture and supply, there will be nothing left for other members to write upon, when their turn comes. Besides, a single point, well handled—exhaustively handled—is of a far higher educative value, and is more likely to provoke discussion, than is a paper which introduces a multitude of points, some of them quite elementary, others highly argumentative. This does not detract from the value of the papers. My complaint rather is that the papers are like a too rich plum pudding—they are not so suitable for digestion as plainer fare would be. It must be freely acknowledged that the authors have put themselves to no end of trouble in order to be able to present their subjects in as complete a form as possible. The discussions, too, upon both papers were remarkably straightforward and pointed. What is more pleasing—and a higher compliment could not be paid to the Association—they were altogether free from the personal element, either on the side of an overweening opinion of themselves, or of intolerant criticism of others.

The New Year holiday seems to have been still in evidence in Dundee on Tuesday, the 3rd inst., for it is reported that on that day a deputation of the Fourth Ward ratepayers paid a visit of inspection to the Dundee Corporation Gas-Works. The deputation, which consisted of thirty-seven members, was introduced by Councillor Mathers, who had kindly made the arrangements. At the gas-works the company were met by Mr. Yuill, the Manager, who, it is said, showed them over the establishment, furnishing the most exhaustive explanations. At the conclusion of their tour, the visitors expressed themselves as delighted with what they had seen, that they were satisfied with the perfection of the arrangements, and that the new works were all that was claimed for them. Mr. Yuill was cordially thanked by the visitors, as was also Councillor Mathers.

At the Dundee Police Court on Saturday last, John Goldie, tinsmith, residing in Hospital Wynd, was charged with having stolen 100 cubic feet, or thereby, of gas. He admitted the charge. The prosecutor stated that Goldie had been the tenant of a small workshop in Nethergate for the past seven months; that there were no gas-fittings in the place, but that on Friday information was received at the gas office that the accused was burning gas in his premises. An examination was made, and it was found that he had connected a pipe with a gas service.

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

W. H. PEARSON, Chairman.
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CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
BLACKBURN	1,250,000	ST. CATHERINES (Remodelled)	250,000	TONBRIDGE	300,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	KINGSTON, PA.	125,000	STRETFORD	500,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT.	250,000	OLDBURY	300,000
COLCHESTER	300,000	WILKESBARRE, PA.	750,000	TODMORDEN	500,000
BIRKENHEAD	2,250,000	ST. CATHERINES (2nd Cont.)	250,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	YORK (Second Contract)	750,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN.	500,000	ROCHESTER (Second Contract)	500,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	COLCHESTER (Second Contract)	300,000	NEWPORT (MON.)	250,000
HALIFAX	1,000,000	YORK	750,000	TOKIO, JAPAN	1,000,000
TORONTO	250,000	ROCHESTER	500,000	PERNAMBUCO (Brazil)	125,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	MALTON	150,000
LINDSAY (Remodelled)	125,000	CRYSTAL PALACE DISTRICT	2,000,000	DULUTH, MINN. (2nd Cont.)	300,000
MONTREAL	500,000	DULUTH, MINN.	300,000	BROCKVILLE (ONT.)	250,000
TORONTO (Second Contract Remodelled)	2,000,000	CATERHAM	150,000	SMETHWICK	500,000
BELLEVILLE	250,000	LEICESTER	2,000,000	GRAVESEND	300,000
OTTAWA (Second Contract)	250,000	ENSCHEDE (HOLLAND)	150,000	NEWPORT MON. (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	TORONTO (Third Contract)	750,000
		BURNLEY	1,500,000	TORONTO (Fourth Contract)	1,000,000
		KINGSTON-ON-THAMES	1,750,000	MONTREAL, ONT. (2nd Cont.)	1,800,000
		ACCRINGTON	500,000	HAMILTON, ONT.	400,000

LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft.

AND, IN ADDITION, 5,300,000 CUBIC FEET DAILY; also Coal-Gas Plants at NELSON, B.C., CHATHAM, BERLIN, NAPANEE, OWEN SOUND, CALGARY, and WINNIPEG.

The matter was reported to the police; and on a sergeant calling at the place, he found Goldie using gas. Bailie Quirk imposed a fine of 10s., with the alternative of seven days in gaol—which certainly does not err on the side of severity.

Following upon the ratification by the ratepayers of Monifieth of the policy of the Town Council in adopting the Burghs (Scotland) Gas Supply Acts, the Council have, in accordance with statutory requirements, presented a petition to the Sheriff of the county of Forfar to have their resolution registered.

The last of the ten men who were convicted in the High Court of Justiciary in Edinburgh in December, 1883, of having been concerned in dynamite outrages in Glasgow, has been relieved from police surveillance. The outrages occurred on the night of Jan. 20, 1883, and consisted of an attempt to blow up one of the gasholders at the Tradeston Gas-Works of the Glasgow Corporation, and a building at Buchanan Street railway station, and to destroy the bridge which carries the Forth and Clyde Canal across Possil Road, by which it was expected that a portion of Glasgow would be thrown into darkness, and other portions flooded. Five of the convicted men were sentenced to penal servitude for life, and the other five for seven years.

A new Gas Company is being formed at Kelty, in Fifeshire. It was mentioned in these "Notes," in the course of last summer, that there was a movement on foot for the creation of a lighting district at Kelty, and that a section of the District Committee of the County Council—who are the Local Authority in such matters—were in favour of taking a supply of gas from the Cowdenbeath Gas Company; while another section were in favour of the formation of a Gas Company in Kelty. The latter have prevailed. At a meeting of the District Committee on Tuesday last, a letter from Messrs. Corrie and Son, solicitors, of Dunfermline, was read, intimating that a Memorandum and Articles of Association had been made up in connection with the Kelty Gaslight Company, and that the Company would be registered at an early date. The letter was sent to a Committee for a report. The word "Light" might well be dropped from the title of the Company. In former days it was quite appropriate, but now gas companies are not lighting undertakings alone.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan. 7.*

Sulphate of Ammonia.

Again there has been a quiet market; for although there has been a very considerable inquiry, the large buyers have been directing their efforts to getting in at a further decline, without much success however. The larger makers maintain a firm attitude, not being overburdened with supplies; but small parcels have in some cases been disposed of at something under current quotations. The closing prices remain £12 12s. 6d. per ton f.o.b. Hull, £12 15s. per ton f.o.b. Liverpool, and £12 17s. 6d. per ton f.o.b. Leith. There is nothing to report in the forward position, the views of makers and buyers being too divergent to admit of business.

Nitrate of Soda.

This article is barely steady; but the closing quotations are 11s. to 11s. 3d. per cwt., according to quality.

LONDON, *Jan. 7.*

Tar Products.

There has been an absence of business during the past week; and as a rule prices are a little easier all round. In anthracene, the position remains precisely the same. There is too much difference at present between the ideas of manufacturers and consumers to permit of any business resulting. The market value of benzol may be taken as 10d. per gallon for 90 per cent. f.o.b. London; but there are sellers in the North at 9½d. for prompt delivery. As regards 50-90 per cent., there is really nothing doing. As a rule, makers ask 8d. per gallon; but business is reported in the Manchester district at 7½d. for prompt delivery. The position of toluol solvent remains unchanged, and there is really no business to report. In pitch, the largest London makers still quote 38s. to 38s. 6d.; but dealers will accept very much under these prices for early delivery. There is rather a wide range as regards London values just at present; and it is very difficult to fix the actual price at which business would be possible. In South Wales, there is still a good inquiry over the first six months of the year; but no business has at present resulted, as consumers are not at all inclined to pay the prices asked by dealers. Consumers of carbolic acid certainly do not show so much anxiety to purchase as was the case a little while ago; and it would appear that the German consumers are rather inclined to hold off the market just at present. In crystals, however, the demand still continues very good, and there are reported to be several inquiries in the market for forward delivery. The market for creosote is decidedly quiet, both in London and in the Provinces. Some considerable business was done in Yorkshire at 1¼d. per gallon for delivery over the next three months; while in London it is reported that further second-hand sales have been made at 1¼d. The largest producers here still quote from 1⅝d. to 2d.; but business is quite impossible at these prices for the present.

The average values during the week were: Tar, 18s. to 22s. Pitch, London, 36s. to 37s. 6d.; east coast, 34s.; west coast, 33s. 6d. to 33s. 9d. Benzol, 90 per cent., 10d.; 50-90 per cent., 8d. Toluol, 7½d. to 7½d. Crude naphtha, 3½d.; solvent naphtha, 8½d. to 9d.; heavy naphtha, 10d. Creosote, London, 1½d. to 1⅝d.; North, 1¼d. Heavy oils, 2 1/16d. to 2⅛d. Carbolic acid, 60 per cent., 2s. 1½d. to 2s. 2d. Refined naphthalene, £4 to £9; salts, 18s. to 21s. 6d. Anthracene, "A" quality, 1½d. to 1⅝d.; "B" quality, unsaleable.

Sulphate of Ammonia.

There has been an absence of business during the past week; but markets are as a rule in practically the same position. Business is reported in Beckton make at £13 2s. 6d. and £13 3s. 9d. for January shipment; while £13 5s. is now the price for February-March. There is no business reported in the South Metropolitan, whose price remains

THE

MAXIM PATENT

CARBURETTOR

For Enriching Gas in Bulk.

Prevents Naphthalene Deposits.

OVER . . . . .

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MAXIM PATENT CARBURETTORS

HAVE NOW BEEN FIXED.

Among the Companies and Towns supplied are The Gaslight and Coke Company, The South Metropolitan Gas Company, Birmingham, Leeds, Rochdale, Bristol, Sheffield, Oldham, Dundee, Perth, Dunfermline, and many other Works, both large and small, where they have been working in some instances for the past **Ten Years.**

More Gas and Saleable Coke per Ton of Coal Carbonized is produced; saving Capital, Labour, Fuel, Wear and Tear, &c.

THE ENRICHMENT IS INSTANTANEOUS AND PERMANENT.

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

DEALERS IN

Benzol, Carburine, and all other Naphthas and Oils suitable for the Enrichment or Production of Gas.

For Prices and full Particulars, apply to the

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LIMITED,

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BISHOPSGATE, LONDON, E.C.

unaltered. Further sales have been made in Hull at £12 16s. 3d. for shipment at the end of January and early in February; while for February only makers ask £12 17s. 6d., but for prompt consumers as a rule only offer £12 15s. In Leith, business is reported by dealers at £12 17s. 6d.; but makers are still fairly firm at £13 for January shipment.

COAL TRADE REPORTS.

Lancashire Coal Trade.

Work at the Lancashire collieries, after the New Year's holidays, was resumed generally on Wednesday. The demand for slack continues very active; but the supply is not over plentiful, and prices consequently are very firm. Coal for shipping continues to be dispatched to the Partington and Cadishead tips with fair regularity. Coal and cannel for gas-making purposes are being delivered according to existing contracts, which will continue for some time. There is no change to record in prices.

Northern Coal Trade.

There is now a full output from the northern collieries; and it is so far generally well taken up, for in the holiday time the stocks of fuel in the hands of consumers have been reduced. The demand is therefore a little quicker, though that for steam coals is not likely to give full work for very long to all the pits. Best Northumbrian steams are quiet at 9s. per ton f.o.b., second-class are from 8s. to 8s. 1½d., and smalls are rather firm at from 4s. to 4s. 9d., according to quality. In the gas coal trade, there is a full demand, and deliveries continue on the highest scale; but they are chiefly on the long contracts, so that the prices are not influenced. For occasional sales, the current values range from about 7s. 10½d. to 8s. 3d. per ton f.o.b., though one or two well-placed collieries ask higher prices. Contracts are very few now; but one or two export sales are being arranged. Gas coke is plentiful, and at some inland works stocks are heavy; but where there is an export trade, the price of good gas coke is firm at 13s. per ton f.o.b.

Scotch Coal Trade.

For the last week of 1904, the shipments of coal in Scotland amounted to 228,490 tons—an increase of 2261 tons upon the preceding week, and of 57,929 tons upon the corresponding week of the previous year. For the whole year, the shipments amounted to 11,792,945 tons—an increase of 459,943 tons upon 1903. The quantity of coal exported is returned at 7,226,291 tons—which leaves 4,566,654 tons as having been carried coastwise. The quantity raised has not yet been ascertained.

TRADE NOTES.

Underfeed Stoking for Boilers.

The mechanical stokers which are now so extensively used may be divided into two classes—the "overfeed" and the "underfeed"—according to the way in which they supply fuel to the fire. By the former method, the fresh coal, falling suddenly upon an incandescent mass of glowing fuel, liberates combustible gases with great rapidity; the result being that imperfect combustion takes place, and smoke passes up the chimney and causes nuisance. When the fire has again become bright, more coal is necessary, and the process is repeated. The consequence is that the fires are alternately hot and clear, cold and smoky. By the system of underfeeding, on the contrary, the fresh coal is gradually advanced upwards towards the zone of combustion, and the effect is to keep a perpetually clear, bright surface of incandescent fuel. The method of achieving this desirable result is fully explained in an illustrated pamphlet which has been issued by the Underfeed Stoker Company, Limited, of Coventry House, South Place, Finsbury, which contains a full description of the various types of stoker manufactured by them for internally fired and all kinds of water-tube boilers. The Company claim for their stoker that by its use smoke may be prevented, even with the most highly bituminous coals, while inferior slack may be burnt; that the capacity of the boiler is increased and its life prolonged; and that consequently considerable economy may be realized. That too much is not being claimed for the stokers may, we think, be inferred from the fact that they are now in use in large numbers in various parts of the world.

A Science Year Book.

We have received from Messrs. King, Sell, and Olding, Limited, "The Science Year Book" for 1905. It consists of an almanac and diary, a biographical directory, a summary of progress in science, a list of scientific societies, and a glossary—all produced under the editorship of Major B. F. S. Baden-Powell (late Scots Guards), the President of the Aëronautical Society. This is the first year of issue, and the Editor acknowledges his indebtedness to various well-established sources of information in the compilation of the contents. He has endeavoured to render his work useful to all interested in science; and he appears to have been very successful. In the diary, one page is given to each day; the top portion being occupied with useful astronomical and other information, with spaces for recording weather notes. The diary is followed by forms for entering dates of correspondence and cash transactions. A novel feature of the book is an opening in the cover which allows a monthly tear-off engagement calendar beneath to be seen. There is a useful index to the contents, and also a calendar for 1906. A fine portrait of Lord Kelvin forms an appropriate frontispiece. Altogether, the Editor may be congratulated on his first production, the every-day use of which will probably indicate where it may be improved in subsequent issues.

Steam-Raising Value of Town Refuse.

As doubts have been expressed from time to time in the "JOURNAL" as to the steam-raising value of town refuse, Messrs. Meldrum Bros., Limited, have forwarded to us an extract from a letter by the Engineer

PARKINSON'S

GAS-FIRES.

THE "CROWN."

Elegance.

Efficiency.

PARKINSON AND W. & B. COWAN, LTD.

(PARKINSON BRANCH),

COTTAGE LANE, CITY ROAD, LONDON. | BELL BARN ROAD. BIRMINGHAM.

in charge of the destructor plant at Burnley. It contains the following figures extracted from the weekly returns for the quarter ending the 25th of June: In the first week, the quantity of refuse used was 183 tons, and the water evaporated was 818,780 lbs.; in the second week, the figures were 179 tons and 781,480 lbs.; third week, 207 tons and 748,260 lbs.; fourth week, 178 tons and 679,140 lbs.; fifth week, 188 tons and 692,460 lbs.; sixth week, 212 tons and 647,800 lbs.; seventh week, 211 tons and 638,100 lbs.; eighth week, 190 tons and 617,000 lbs.; ninth week, 210 tons and 655,400 lbs.; tenth week, 181 tons and 626,800 lbs.; eleventh week, 212 tons and 614,500 lbs.; twelfth week, 221 tons and 799,200 lbs.; and thirteenth week, 266 tons and 960,300 lbs. In each of these cases, except the last, the water evaporated is for six days; in the last case it is for seven days. The results were so satisfactory that the Corporation have had a further installation of plant built to deal with the rest of the refuse of the borough. Messrs. Meldrum question whether there are many coal-fired boilers of the same size as those at Burnley giving as much steam when using the best Welsh coal instead of the unscreened town refuse which is there turned to such useful account.

Purifier Contract for the Whessoe Foundry.

The Whessoe Foundry Company, Limited, of Darlington, have been awarded the important contract for a large purifying plant for the Edinburgh Gas-Works. Included in the contract is the supply and erection of six purifiers, each 45 feet by 30 feet, and 6 feet deep, complete with grids, valves, and 30-inch connections.

Calendars and Almanacs for 1905.

Among other productions of this class which have reached us, we may mention a date block from Messrs. Fletcher, Russell, and Co., Limited. We have also received from the Secretary of the Midland Railway Temperance Union the sheet almanac for the current year issued by the Union. It contains some interesting statistics which show that the Company have 17 coal and oil gas-works, which produced last year 273,437,200 cubic feet of gas from coal and 46,087,900 cubic feet from oil. There are 4826 carriages lighted by gas, and 45,293 incandescent gas-lights are in use; compared with 4695 carriages and 35,050 lights in the preceding year.

Devonport Water Arbitration.—In addition to their decision to refer back to the Umpire (Mr. A. J. Ram, K.C.) the award in the arbitration respecting the purchase of the Devonport Water-Works, the Water Company have notified the Corporation of their intention to appeal against the decision of Mr. Justice Phillimore, in the King's Bench Division, as given in the "JOURNAL" for the 27th ult. It is anticipated by both the Corporation and the Company that the case will be carried to the House of Lords.

New Gas and Water Capital Created in the Second Half of Last Year.—Among the principal issues of new capital offered by tender in the six months ending the 31st ult. were the following: Commercial Gas Company, 4 per cent. capital stock, £9595; Derwent Valley Water Board, bills, £100,000; East Surrey Water Company, £10 ordinary shares, £8000; Metropolitan Water Board, 3 per cent. "B" stock, £1,500,000; Sutton District Water Company, 4½ per cent. preference stock, £25,000. Out of a total of £2,134,640 offered, £9595 was required for gas and £1,642,595 for water purposes.

Chard Gas-Works Purchase.—The difficulty into which the Chard Corporation have been plunged with regard to the purchase of the gas-works, formed the subject of discussion at a meeting of the Town Council on Thursday last. As the price to be paid for the works is very much higher than the Corporation expected, the capital charges threaten to embarrass the undertaking; and it was decided to send a deputation to the Local Government Board to obtain their views on the question of an extension of the period for the repayment of the loan. If the Board's opinion is favourable, the Corporation propose to obtain a Provisional Order extending the period for repayment from 30 years to 40 years or longer. The Council have to complete the purchase by the 24th of June next.

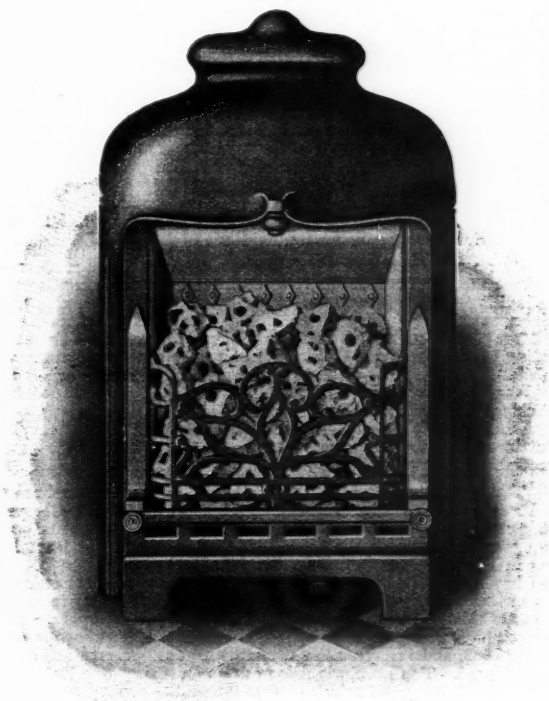
Serious Gas Explosion at Cardiff.—Cardiff was the scene of a serious gas explosion last Tuesday morning, when the house of the American Consul (the Hon. D. T. Phillips) was partly wrecked, his daughter received a severe shock, a servant girl was badly burned, and Mr. Phillips himself (who had been ill for some time) subsequently died—his death, it is said, being probably accelerated by the occurrence. About 7 o'clock, the servant (Ruth Jenkins) went into one of the rooms to light the fire; and as it was dark she struck a match and lit the gas. No sooner had she done so than there was an explosion, followed by the almost total wrecking of the room; while she herself was badly scorched. Mr. Phillips was removed from his bed to the house of his doctor, and then appeared quite calm; but later in the day he was found to be sinking rapidly, and shortly expired. It is stated that the gas escaped from a pendant, owing to the absence of water.

Bideford Water Supply.—Considerable inconvenience was caused at Bideford last summer by the shortness of the water supply. Reference was made to the subject at a meeting of the Town Council on Thursday, when Alderman Dymond moved that the Surveyor should be instructed to ascertain and report as to which mains need renewing, and the probable cost. Mr. Dymond remarked that the Surveyor had informed them that many of the old mains were so corroded that he could scarcely put his finger on them. Mr. W. T. Godman remarked that they knew the mains ought to be relaid; but if they were not prepared to do it, it was no use discussing the subject. Mr. J. M. Metherell said the finances were not in a condition to permit them to undertake the relaying of all, nor even half, the mains in the town. Half the town might be in the state described by Mr. Dymond; but so long as the water went through the pipes and there was no contamination, he did not think they should meddle with them. It was decided that the question should be deferred.

The "MAIN"

Gas Fires

NEW AND ARTISTIC DESIGNS.



Burner and Bricks removable; extra deep Fire.

The "WESTMINSTER" No. 1030 . . £2

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LONDON. GLASGOW, FALKIRK, &c.

Companies Wound Up in the Past Year.—Among the companies which were wound up voluntarily last year were the Natural Gas-Fields of England, the Tavistock Gas, Coke, and Coal Company, and the Thomas Lighting Company—the two latter with a view to continued existence in another form. A winding-up order was made in the case of the Scott-Snell Self-Intensifying Gas-Lamp Company.

In consequence of the serious rise in the price of metals, manufacturers of gas-fittings, &c., are notifying a rise of 5 per cent. in brass and other goods.

Under the title of Ramie Mills, Limited, a Company has been registered with a capital of £500, in £1 shares, to carry on the business of cotton, silk, wool, flax, hemp, and jute manufacturers, dealers in flax, ramie, and rhea fibre, cotton and ramie spinners, &c.

The Chemical Engineering Company and Wilton's Patent Furnace Company have been favoured with an order (per Messrs. John Terry and Co.) from the Melbourne Gas Company for one of their patent closed saturators, liquor stills, and lime pumps, all complete with heater and condenser.

Municipal trading has entered upon a new phase at Norwich, where the Corporation are pressing the aid of attractive advertising into their service. They have reduced the cost of the electric light from 5d. to 4½d. per unit, and in their advertisements in the local newspapers they offer to wire premises free of initial cost to the consumer. They make a prominent feature of an appeal to the citizens to "deal at their own shop."

By an announcement made in the "JOURNAL" last week, our readers were informed of the intention of the Directors of the Reading Gas Company to issue £20,000 of new ordinary stock, to rank for a maximum dividend of 5 per cent. per annum, and their desire to receive tenders for it, which must be sent in by next Monday. The minimum price is £105 per £100 of stock. Since 1899, the sale of gas in the Company's district has increased by 25·66 per cent.; and at the close of 1903 a balance of £16,434 of undivided profit was carried forward, after providing for the maximum dividends to that date.

By an announcement which appears elsewhere, our readers will see that the Directors of the Bournemouth Gas and Water Company are inviting tenders for an issue of £10 "B" shares (7 per cent.), at a minimum price of £15 each, to be paid up in full on or before the 31st of March. The dividend on the ordinary shares for the six months ending June 30 last was at the rate of 10 per cent. per annum, with an addition at the rate of 4 per cent. under the sliding-scale. The net profit earned in the year ended the 30th of June last, after deducting all charges, including debenture interest, amounted to £31,499, which was available for dividends; and after payment of these, £8778 remained to be carried forward to the half year ending the 31st of December.

The Hampstead Borough Council have decided to purchase the undertaking of the North-West London Electric Supply Company. This concern, which was formerly known as the Hampstead Battery Company, has offices and a generating station near the Midland Railway in Finchley Road, almost exactly in the centre of the borough, and has been a rival with the Council for the supply of electricity in one of the wealthiest parts. Several years ago, the Vestry secured an Order enabling them to establish a municipal electric supply, and the Council have now 5000 customers. The capital expenditure amounts to £346,608, and last year the income was £58,051, and the surplus profit £5796. The purchase price of the Company's undertaking is £12,000, which is to be paid for out of the profits already made, which have hitherto formed the basis of a reserve fund.

On Thursday, the 29th ult., Mr. J. H. Buckley, the Manager of the Formby Gas Company, and Mrs. Buckley entertained the whole of the employees at dinner in the Company's show-room. The viands were cooked by gas by Mrs. Fowler, one of the demonstrators for the Richmond Gas Stove and Meter Company, Limited. The guests numbered 30. Mr. Buckley presided, and Mr. F. H. Buckley proposed the toast of "Success to the Formby Gas Company," which was responded to by the Chairman, who proposed the health of the oldest servant of the Company, Mr. Henry Bradshaw, who was the first stoker employed by them, and who had previously been engaged in helping to erect the works. The health of Mr. and Mrs. Fowler, in association with the toast of "Success to the Richmond Gas Stove and Meter Company," was given by the Chairman, and replied to by Mr. Fowler, the Company's representative in this part of the North of England. Mr. T. Dickinson proposed the health of Mr. and Mrs. Buckley, who were cordially thanked for their hospitality; and testimony was borne to the excellent manner in which the viands had been prepared by the aid of gas cooking-stoves. A musical evening followed.

The ever-watchful Secretary and Manager of the Newmarket Gas Company (Mr. J. H. Troughton) never loses an opportunity of bringing under the notice of the inhabitants of the town the economy of gas, whether used as an illuminant or as a producer of heat or motive power. His latest effort takes the form of a circular, in which he declares in bold letters, printed in red, that 11⅛ cubic feet of gas, costing only ½d., are equal to a unit of electricity, costing 7d., giving light for light. The comparative values of the two illuminants are strikingly shown by circles and lines, drawn to scale, and also printed in red. A spot half-an-inch in diameter, or about the size of a threepenny piece, represents the amount of light obtained for 6d. from an electric glow lamp; whereas for the same amount, with gas at 3s. 8d. per 1000 cubic feet, by having modern incandescent gas-burners, the light obtainable is represented by a spot 3½ times as large. The difference in the lengths of the lines is equally striking. Represented in this form, the comparison of the two lights produces a more lasting effect than a page of print, interspersed with calculations, would do; and it is to be hoped that it will lead to additional business. The Company are fully able to cope with it.

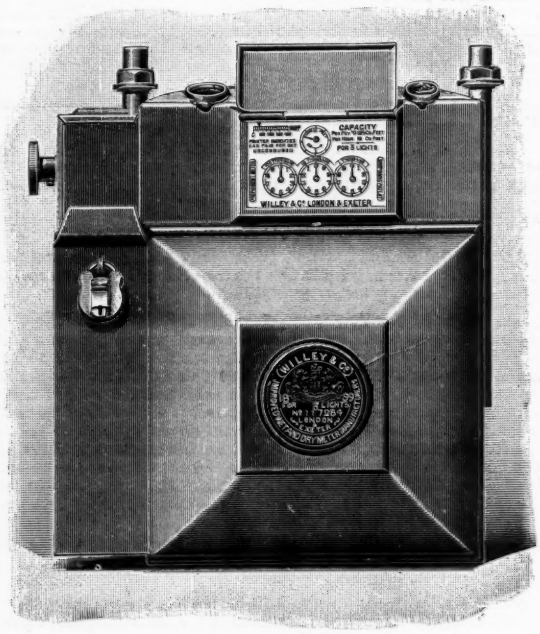
THREE POINTS

of advantage from the many found in our Slot Meters are:

1st.—They are Fraud Proof, and Cannot be tampered with through the Slot.

2nd.—The Slot is closed when the maximum number of Coins have been inserted.

3rd.—Our Price-Changing System is the Simplest, Quickest, and most Accurate yet devised.



ALL PARTS INTERCHANGEABLE.

Tens of Thousands in use, and adopted exclusively by many Gas Companies.

WILLEY & CO., LTD., LONDON & EXETER.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

SUPERINTENDENT. Sheffield Gas Company. Applications by Jan. 12.
DRAUGHTSMAN. West's Gas Improvement Company, Miles Platting.
TRAVELLER. No. 4318.
ASSISTANT DISTRICT INSPECTOR. Reading Gas Company.
WORKING MANAGER. Hay Gas-Works.
FOREMAN MAIN AND SERVICE LAYER. Woolton Gas-Works.
MAINTENANCE DEPARTMENT. Dartford Gas-Works.

Agents Wanted. No. 4319.

Situation Wanted.

ENGINEER AND MANAGER. No 4320.
INCANDESCENT MANTLE MANUFACTURE. No. 4313.

Tank Waggons to Let. Clayton Aniline Company.

Plant for Sale.

ACETYLENE PLANT. Working Men's Club, Barnsley.
PURIFIERS. Knowle Gas Company.
STATION GOVERNORS. R. Dempster and Sons, Elland.
SULPHATE SATURATOR. No. 4314.

Loans on Mortgage. Derwent Valley Water Board.

Stocks and Shares.

BELL'S ASBESTOS COMPANY. Jan. 19.
BOURNEMOUTH GAS AND WATER COMPANY. Jan. 26.
BRIGHTON AND HOVE GAS COMPANY. Jan. 19.
CROYDON GAS COMPANY. Feb. 1.
GUILDFORD GAS COMPANY. Jan. 17.
IPSWICH GAS COMPANY. Jan. 19.
LOWESTOFT WATER AND GAS COMPANY. Jan. 17.
MAIDENHEAD GAS COMPANY. Jan. 17.
NATIONAL TELEPHONE COMPANY. Jan. 19.
NEWCASTLE AND GATESHEAD WATER COMPANY. Jan. 17.
READING GAS COMPANY. Jan. 16.
REDHILL GAS COMPANY. Jan. 19.
SOUTHGATE AND DISTRICT GAS COMPANY. Jan. 17.
TOTTENHAM AND EDMONTON GAS COMPANY. March 1.

TENDERS FOR

Fire-Clay Goods.

BURY GAS DEPARTMENT. Tenders by Jan. 16.

Gasholder.

COVENTRY GAS DEPARTMENT. Tenders by Jan. 16.

Oxide (Spent).

DUMFRIES GAS-WORKS.
LEITCH AND CO., Huddersfield.

Tar and Ammoniacal Liquor.

DARENTH ASYLUM. Tenders by Jan. 21.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

TERMS OF SUBSCRIPTION to the "JOURNAL."

United Kingdom: One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.
Payable in Advance. If credit is taken, the charge is 25s. a year.

Abroad (in the Postal Union): £1 7s. 6d., payable in Advance.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1905, are reminded that this can only be done during the current month.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

BOOKS AND LEAFLETS

TO BE OBTAINED OF

WALTER KING,
11, BOLT COURT, FLEET STREET, E.C.

CALORIMETRY OF PRODUCER AND ILLUMINATING GASES.—By JOHN F. SIMMANCE, Assoc. M.Inst.C.E., M.Inst.Mech.E. *Price 2s.*

PRACTICAL PHOTOMETRY: A GUIDE TO THE STUDY OF THE MEASUREMENT OF LIGHT.—By W. J. DIBDIN, F.I.C., F.C.S., late Chemist and Superintending Gas Examiner to the London County Council. *Price 7s. 6d.*

CHEMICAL TECHNOLOGY.—ELECTRIC LIGHTING. By A. G. COOKE, M.A., A.M.Inst.C.E. PHOTOMETRY. W. J. DIBDIN, F.I.C., F.C.S. 1 Vol. *Price 2Cs.*

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GASHOLDER AND TANK AT THE SUTTON GAS-WORKS (one million cubic feet capacity).—By F. SOUTHWELL CRIPPS, Assoc.M.Inst.C.E. *Price 3s. 6d.*

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"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
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PREPARED from Pure Iron.
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MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

SPENT OXIDE.
THE South Metropolitan Gas Company are always open to receive OFFERS of SPENT OXIDE.
Chief Office: 709, Old Kent Road, London, S.E.
Telegrams: "METROGAS, LONDON."

ROBERT DEMPSTER & SONS, Ltd., Contractor for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, ROSE MOUNT IRON-WORKS, ELLAND.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

ATTERTON'S Patent Charging Machine, especially adapted for Small Works up to 50 Millions. Nearly 40 already supplied, and still supplying. Would soon repay for small outlay. Increased make and reduction in cost.
Apply to E. PADFIELD AND CO., 96 & 98, Leadenhall Street, LONDON, E.C.

SULPHATE OF AMMONIA SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
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Samples and Price on Application.

GLASS SHADES of every description, for all kinds of Interior **GAS LIGHTING.** Illustrated sheets on application.
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For Price and Analysis write to the NEW WESTBURY IRON COMPANY, LIMITED, WESTBURY, WILTS.

GAS and Water Works Supplies and Construction Company, Limited, are open to purchase small or large Gas-Works. Constructors for all Gas and Water Work and Main Laying. All Gas and Water Works Plant and Fittings supplied. Gas and Water Works Financed. Shares and Stock accepted in part payment for Work and Materials supplied. Gas and Water Works Shares and Stock Underwritten and Issued.
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INCANDESCENT Mantle Manufacture. Advertiser, with valuable experience of Factory Management and a Thorough Knowledge of the various processes worked throughout Europe, is open to Engagement, preferably in England.
Address No. 4313, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ENGINEER and Manager of Borough Gas-Works is open to an Engagement elsewhere. Slot consumption doubled, general consumption 24 per cent. increase in Two Years. Works cost per 1000 cubic feet sold 33 per cent. less.
Address No. 4320, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

DRAUGHTSMAN wanted, Experienced in Mechanical and Constructional Engineering.
State Age, Experience, and Salary required to WEST'S GAS IMPROVEMENT COMPANY, LIMITED, Miles Platting, MANCHESTER.

WANTED, an Experienced Man, capable of undertaking Maintenance of Consumers' Incandescent Burners and General Gas-Fitting (Internal Work and Service Laying). Wages, 30s. per week.
Apply, by letter, to the ENGINEER, Gas-Works, DARTFORD.

WANTED, a Steady, Sober Man accustomed to Main and Service Laying, Meter Fixing, &c., and to act as Foreman of a 20 Million Works. Good, permanent position to a suitable man.
Apply, stating Age, Wages expected, with *copies* of recent Testimonials, to the MANAGER, Gas-Works, WOOLTON, Nr. Liverpool.

AGENTS wanted, on Commission, in important centres of business, for the Sale of High-Pressure Gas-Lamps and Accessories. Must be resident in the respective districts, and have a good connection among likely purchasers.
Apply, by letter, with full Particulars, to No. 4319, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TRAVELLER wanted for London and District. Must be well connected among Ironmongers, Gas-Fitters, and Plumbers, and able to interview Gas Engineers, &c. Permanency for suitable applicant.
Apply, by letter, stating Salary required, full Particulars of past Experience, and enclosing References, to No. 4318, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

READING GAS COMPANY.

WANTED, an Assistant District Inspector. Age not to exceed 35 years. Applicants are requested to send in full Particulars of their Age and Training, together with *copies* of recent Testimonials, and to state Wages required. No one need apply who has not a thorough practical knowledge of Internal Gas Fittings work, Incandescent Burners, District Pressure Taking, &c. A special knowledge of Main-Laying is not necessary.
Applications to be sent in as soon as possible, addressed to the ENGINEER, Gas-Works, READING.

HAY GAS AND COKE COMPANY, LIMITED.

WANTED, a Working Manager, competent to take entire Management of Works and Manufacture Gas himself. Must be good Main and Service Layer, thoroughly competent and experienced Fitter, and able to Manage Gas-Engine and Exhauster. About 450 Tons of Coal carbonized annually. Salary 27s. per Week, with House at Works (Taxes free), Lighting, and Fuel.
Applications, in own hand-writing, stating Age, Experience, whether Married, with Three recent Testimonials (including one from present Employers), and when at liberty, to
CHAS. GRIFFITHS, Junr.,
Secretary.
Bank Chambers, Hay,
Via Hereford.

SHEFFIELD UNITED GAS LIGHT COMPANY.

THE Directors of this Company require a SUPERINTENDENT for their Neepsend Gas-Works. Preference will be given to one who has been used to Regenerative Furnaces and Mechanical Stokers. The maximum make of Gas at this Station is about 8 Million cubic feet per day.
Commencing salary £300 per Annum, with House near the Works, Rent, and Rates free.
Applications, marked "Superintendent," stating Age whether Married or Single, and previous Engagements, to be made by letter only, addressed to the undersigned, must be delivered by post, not later than Thursday, Jan. 12, 1905.
HANBURY THOMAS,
General Manager and Secretary.
Commercial Street,
Sheffield, Dec. 22, 1904.

TO LET ON HIRE.

CYLINDRICAL Tank-Waggons suitable for the carriage of Benzol or Crude Naphthas.
Apply, CLAYTON ANILINE COMPANY, LIMITED, Clayton, MANCHESTER.

FOR SALE—Three Purifiers, 6 ft. by 6 ft. by 3 ft. 6 in., with 6-inch Centre Valve and Connections, in good condition. Replaced by larger.
Apply to the KNOWLE GAS COMPANY, nr. BIRMINGHAM.

FOR SALE—An Acetylene Gas Plant for 60 Lights. In good working condition. What offers?
Apply to WORKING MEN'S CLUB, Hoyland Common, NEAR BARNSLEY.

NEW Gasholder, 40 ft. diameter by 12 ft. deep, with Steel Standards; also new STEEL TANK to contain same.
Write J. WRIGHT, 181, Queen Victoria Street, LONDON, E.C.

FOR Sale, equal to new, a 12-in. Cowan's STATION GOVERNOR; also one 10-in. Gas Meter Company's, in first-class condition.
Apply for particulars to ROBERT DEMPSTER & SONS, LTD., ELLAND.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

TO BE SOLD CHEAP—Taylor-made Solid Lead SATURATOR of 3 to 4 Tons of Salt per Twenty-four hours Capacity. Body 1¼ inches, bottom 1¼ inches thick lead, with heavy Timber Frame and Cradle. Has well for Sulphate Lifter. Equal to new; replaced by larger size.
For Price and to Inspect, address, in first instance, to No. 4314, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SPENT OXIDE.

THE Gas Commissioners of the Burgh of Dumfries are open to receive OFFERS for the purchase of SPENT OXIDE, about 150 Tons.
Apply to Mr. MALAM, GAS-WORKS.

COUNTY BOROUGH OF BURY.

TO RETORT AND FIRE-BRICK MANUFACTURERS.

THE Gas Committee are prepared to receive TENDERS for RETORTS, FIRE-BRICKS, and FIRE-CLAY required at their Gas-Works.
Forms of Tender may be obtained from Mr. H. Simmonds, Engineer and Manager, Gas-Works, Elton, Bury.
Tenders, sealed and endorsed "Tender for Retorts, &c.," to be sent to the undersigned not later than Monday, the 16th day of January, 1905.
JOHN HASLAM,
Town Clerk.
Municipal Offices, Bank Street,
Bury, Jan. 6, 1905.

GAS TAR.

FOR Sale, at Darenth Asylum, Dartford, Kent, during 1905, a quantity of GAS TAR, estimated at about 450 Barrels in all.
Offers to Purchase, stating Price per Barrel, to be addressed, in sealed envelopes, marked "Gas Tar," to the Sub-Committee at the Asylum.
Offers to reach the Asylum by Saturday, the 21st inst.
Transit Charges to be borne by purchaser.
Jan. 2, 1905.

TO GASHOLDER MAKERS.

THE Gas Committee of the Coventry Corporation invite TENDERS for the Construction, Delivery, and Erection of a TELESCOPIC GASHOLDER of Two Lifts, about 60 feet diameter, the Lifts being each 20 feet deep, at their Foleshill Works.
Specification, Form of Tender, and Schedule of Quantities, together with prints of the drawings, may be obtained on application to the undersigned, and on payment of One Guinea (which will not be returned).
The Committee do not bind themselves to accept the lowest or any Tender.
Tenders must be delivered not later than first post Monday, the 16th day of January next, addressed to the Chairman of the Gas Committee, Gas-Works, Coventry, and endorsed "Tender for 60 feet Gasholder."
FLETCHER W. STEVENSON,
Engineer and General Manager.
Gas-Works, Coventry.
Dec. 23, 1904.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
GUILDFORD GAS LIGHT AND COKE COMPANY.

NEW ISSUE OF £5000 ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Jan. 17, 1905, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
LOWESTOFT WATER AND GAS COMPANY.

NEW ISSUE OF 400 ADDITIONAL ORDINARY £10 SHARES,
Ranking for a Maximum Dividend of 7 per cent.; previous issues of similar Shares now receiving 5½ per cent.; also
£1000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Jan. 17, 1905, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
MAIDENHEAD GAS COMPANY.

NEW ISSUE OF £5000 CONSOLIDATED ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Jan. 17, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SOUTHGATE AND DISTRICT GAS COMPANY.
(Formerly called the Colney Hatch Gas Company.)

NEW ISSUE OF £4000 ADDITIONAL ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Jan. 17, 1905, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

SALE BY TENDER OF £12,500 "B" ADDITIONAL CONSOLIDATED STOCK.
MINIMUM PRICE, £100 PER CENT.

IN pursuance of the Tottenham and Edmonton Gas Act, 1898, Notice is Hereby Given that it is the intention of the Directors of this Company to SELL BY TENDER £12,500 of the above Consolidated Stock, to be paid up in full on or before the 15th day of March next; such Stock being a portion of Additional Capital authorized to be raised by resolution passed at an Extraordinary General Meeting of Proprietors held on the 20th of February, 1904, under the Powers of the above-mentioned Act.
Particulars and Conditions, with Form of Tender, may be obtained on application at this Office, and sealed Tenders must be sent in not later than Four o'clock on Wednesday, the 1st of March, 1905.
By order of the Board,
JAMES RANDALL,
Secretary.
Chief Offices: 639, High Road,
Tottenham, Dec. 30, 1904.

THE Derwent Valley Water Board is prepared to receive a limited amount of money upon Mortgage at £3½ per cent. per annum either for a term of years, not exceeding seven, or repayable at six months' notice from either party.

The Derwent Valley Water Board was constituted by Parliament in 1899 to supply water to the towns of Derby, Leicester, Nottingham, and Sheffield, and the monies required for carrying out the necessary Works are, by the powers of the Derwent Valley Water Acts 1899 to 1904, secured upon the Revenues and Rates of the said Towns in due proportion.

Applications to be sent to Mr. W. Gill Hodgson. Accountant to the Board, Bamford, via Sheffield.

By order,
O. B. STEWARD,
Clerk to the Board.

REDHILL GAS COMPANY.

SALE OF ORDINARY "B" STOCK.

NOTICE is Hereby Given, that it is the intention of the said Company to SELL BY TENDER, £5000 OF ORDINARY "B" STOCK of, and in the, Redhill Gas Company.

The last day for the reception of Tenders will be Thursday, the 19th day of January, 1905, at Twelve o'clock, at Noon.

Forms of Tender, with Particulars of Sale and Conditions of Tender attached, can be had upon application at the Company's Office, Brighton Road, Redhill.

By order,
C. READ,
Secretary.

Redhill, Surrey,
Dec. 17, 1904.

To Trustees and Others.—By order of the Directors of

THE CROYDON GAS COMPANY.

SALE OF £10,000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

HOOKER and WEBB have received in- structions to SELL BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Wednesday, the 1st of February, 1905, at Two o'clock precisely, in 114 Lots,

£10,000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK

of the Croydon Gas Company, in lots of from £25 to £100 Stock each. The Reserve and Insurance Funds at Midsummer last amounted to £44,522 8s. 11d.; the paid-up Ordinary Capital at that date was £310,000, whereas the Debenture Stock now amounts to only £45,000, thus showing that the stock offered is a security of the highest class.

Particulars and Conditions of Sale may be had of the SECRETARY, at the Offices of the Company, Katharine Street, CROYDON; at the MART, E.C.; and of the AUCTIONEERS, 4, High Street, CROYDON.

Telephone No. 122 Croydon.

NEWCASTLE AND GATESHEAD WATER COMPANY.

SALE BY AUCTION OF £54,000 (OR THEREABOUTS) OF SEVEN PER CENT. MAXIMUM ORDINARY STOCK (ACT 1898).

MR. CHARLES A. JOEL will Sell by AUCTION, at the Company's Offices, Pilgrim Street, Newcastle-on-Tyne, on Tuesday, the 17th of January, 1905, at Half-past Twelve o'clock in the Afternoon, £54,000 (or thereabouts) of 7 PER CENT. MAXIMUM ORDINARY STOCK, under the Act of 1898, in Lots of £100.

The above Stock is the balance of the 7 per cent. Maximum Ordinary Stock created under the powers of the Newcastle and Gateshead Water-Works Act, 1898.

The dividend is subject to proportionate diminution whenever the maximum dividend to which each class of Ordinary Stock of the Company is entitled shall not be paid in full; but such diminution may be made up in subsequent years.

Printed Particulars and Conditions of Sale may be had at the Company's Offices, and Messrs. George Armstrong and Sons, Solicitors, Newcastle-on-Tyne; or of the Auctioneer, 27, Northumberland Street, Newcastle-on-Tyne.

GEORGE SMITH,
Secretary and General Manager.
Newcastle-on-Tyne, Dec. 7, 1904.

READING GAS COMPANY.
(INCORPORATED BY 25TH AND 26TH VIC. CAP. 84, 30TH JUNE, 1862).

SALE BY TENDER OF £20,000 ORDINARY STOCK.

THE Directors invite Tenders (at not less than £105 per £100 Stock) for £20,000 Ordinary Stock in the above-named Company, to be raised in pursuance of the powers of "The Reading Gas Act, 1902."

This Stock will rank for a maximum dividend of 5 per cent. per annum. Full dividends on the Company's Stocks and Shares have been paid since its Incorporation in 1862.

The Stock will be issued in amounts of not less than £10, or multiples thereof, and will be registered in the names of the purchasers (or their nominees) free of expense.

Payment for the Stock is to be made as follows:—One half of the allotment and the whole of the premium on or before the 31st of January, 1905, and the balance of the allotment on or before the 31st of March, 1905, from which respective dates the dividend will commence to accrue.

The Dividends are paid half-yearly on or about the 1st of March and the 1st of September.

The liability of the Stockholders is limited—that is, when the Stock is paid for there is no further liability.

Particulars, with Forms of Tender, may be obtained on application to the Secretary, to whom Tenders must be delivered not later than Monday, the 16th of January next.

By order of the Directors,
A. CANNING WILLIAMS,
Secretary.

7, King Street, Reading,
Dec. 20, 1904.

BOURNEMOUTH GAS AND WATER COMPANY.

ISSUE OF £10 SEVEN PER CENT. 'B" SHARES.
MINIMUM PRICE OF ISSUE £15 PER SHARE.
SALE BY TENDER OF 1000 £10 SEVEN PER CENT. "B" SHARES,
in Pursuance of the Provisions of the Bournemouth Gas and Water Act, 1896.

NOTICE is Hereby Given, that it is the intention of the Directors of this Company to SELL BY TENDER 1000 "B" SHARES OF £10 EACH (the Dividend on which is limited to £7 per cent.), to be paid up in full on or before the 31st of March, 1905.

The Dividend on the Ordinary Shares for the Half Year ended June 30, 1904, was at the rate of Ten per cent. per annum, with an addition at the rate of Four per cent. per annum under the Sliding-Scale, and on the "B" Shares at the rate of Seven per cent. per annum. Since the 31st of December, 1888, to the 31st of December, 1903, the Dividend on the Original Shares has been at the rate of 13 per cent. per annum.

The net Profit earned in the year ended June 30, 1904, after deducting all charges, including Debenture Interest, amounted to £31,499 6s. 1d., which sum was available for payment of Dividends. During the same Twelve Months, the sum of £2000 was added to Reserve Fund from Profits, and also £707 4s. 1d. from Interest on Reserve Investments, and, after payment of Dividends to June 30, 1904, the sum of £8778 18s. 4d. remained to be carried forward to the Half Year ending the 31st of December, 1904.

Particulars and Conditions of Tender may be obtained at the Company's Offices, Bournemouth, or of the Secretary as under.

Sealed Tenders must be sent to the Secretary not later than Eleven o'clock on Thursday morning, the 26th of January, 1905.

By order,
WILLIAM CASH,
Secretary.

90, Cannon Street, London, E.C.,
Jan. 10, 1905.

IPSWICH GASLIGHT COMPANY.

£250 "A" STOCK. Dividend 12½ per Cent.
£1280 "B" STOCK. Dividend 10 per Cent.
£220 "C" STOCK. Dividend 9½ per Cent.

The Dividends are payable Half Yearly on the 1st of March and the 1st of September. The Price of Gas being now reduced to 2s. 6d. per 1000 cubic feet, the Company have the power to further increase the dividends by ½ per cent. on each class of Stock.

BELL'S ASBESTOS COMPANY, LIMITED.

THREE £100 Five per Cent. MORTGAGE DEBENTURES.

TEN £1 ORDINARY SHARES, upon which the last Dividend was at the rate of 4 per Cent. per annum.

BRIGHTON AND HOVE GENERAL GAS COMPANY.

£500 ORIGINAL ORDINARY CONSOLIDATED STOCK. Dividend, for the Half-Year ended 30th of June, 1904, 11 per Cent.

NATIONAL TELEPHONE COMPANY, LIMITED.

£10 PREFERRED and £20 DEFERRED STOCK.

GARROD, TURNER, and SON will Sell by AUCTION, at the Great White Horse Hotel, Ipswich, on Thursday, the 19th of January, 1905, the above well-secured Investments, by direction of the Trustees of the Will of Mr. George Stanford Clarke, deceased, in 186 Lots.

Solicitor: Mr. W. E. Kersey, 15, Tower Street.
Particulars of the AUCTIONEERS, IPSWICH.

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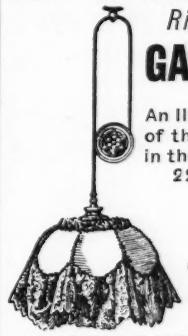
Rising and Falling
GAS PENDANT.



An Illustrated Description of this Pendant appeared in the "Journal" for Nov. 22, 1904 (page 599).

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MIRFIELD GAS COAL

UNEQUALLED.

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INCANDESCENT GAS LAMP.

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MANY DETAIL IMPROVEMENTS.

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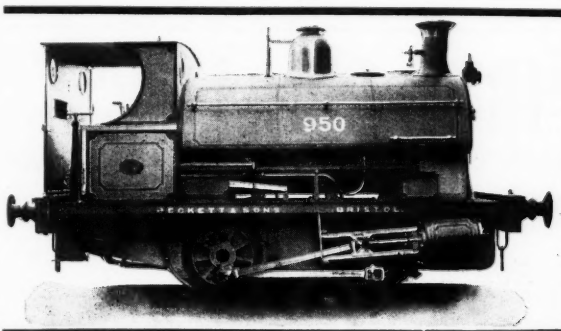

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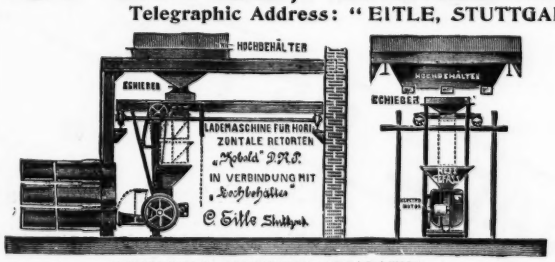
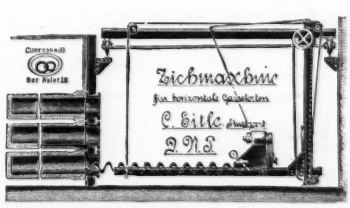


"KOBOLD" CHARGING APPARATUS.



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ADVANTAGES OF THE "KOBOLD" CHARGING APPARATUS.

1.—The simplest of all existing Charging Machines, as in charging there is only ONE shaft working.
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6.—Smallest consumption of power.
7.—Most rapid working, as the complete charging of a retort requires only two pulls of a lever.
8.—May be set at any position in regard to height by either manual or motor power.
9.—Lowest cost to purchase; paying interest and redemption in about three years.

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1.—The simplest and best drawing machine in the world for horizontal retorts.
2.—Least time required to draw a retort (10-15 seconds).
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Mr. R. B. Silcox, Manager of the Garw and Ogmore Gas Company, Pontycymmer, Glam., writes :—

"I am glad to state the lamp you kindly sent us on approval has given entire satisfaction, and my customer has decided to keep same."

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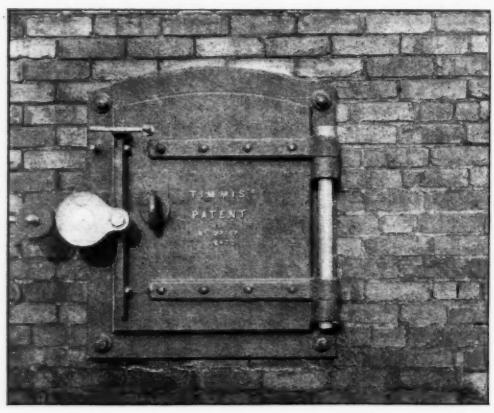
TIMMIS'S PATENT CLINKERING DOOR.

It is a well-known fact that the ordinary Clinkering Door which is fastened only at the middle almost invariably warps with the heat, thereby **admitting primary air in unknown quantities and in the wrong place.** Where two fastenings are used to either single or double doors it is impossible to apply equal pressure with them, and as a rule only one of them is used, the results being worse than with the single fastening. With Timmis's Patent it is impossible to avoid putting equal pressure on both top and bottom, and with the same ease as with the old single fastening.



Advantages.

1. It renders **warping impossible.**
2. **No primary air** can pass into the furnace **between the Door and the Frame.**
3. It is **the only Clinkering Door** that can be **sealed top and bottom by the operation of one fastener.**
4. There are **no complicated parts** to wear or get out of order.
5. **Double Doors** can be **dispensed with.**
6. It occupies **no more room than the ordinary door.**

DESCRIPTION OF DOOR.

TIMMIS'S PATENT CLINKERING DOOR is fastened by means of a vertical bar pivoted in the centre and provided with a screw at the top end. When the screw is tightened, the lower end of the bar is pressed with equal force against the lower corner of the door. **The two corners are therefore subject to equal pressure and warping is impossible.** To release the door the screw is loosened, and the bar, which is balanced by a counter-weight and rotates upon a strong pin attached to the frame, is moved clear of the door. The sketch above shows the position of the bar when the door is closed.

Further Particulars and Prices on Application to the Patentee:

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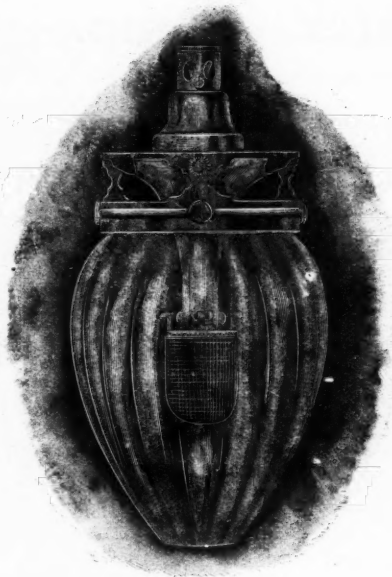
BRITISH MANUFACTURE.

INCREASED DISCOUNTS TO THE TRADE.

New types of BURNERS at popular Prices.



MAXIMUM LIGHT WITH MINIMUM CONSUMPTION OF GAS.

The "Bijou" Burner in clusters for interior lighting has the decorative effect of Electric light at One-Eighth the cost.

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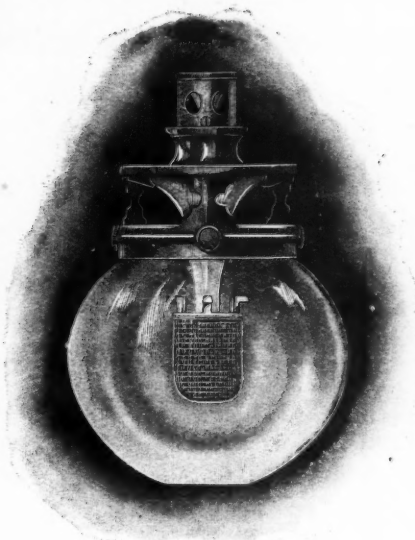

No. 2 Burner only, in Polished Brass or Steel Bronze, 4s. 6d. Globes from 6d. each. Mantles 7s. per dozen.

No. 3 Bijou" Burner only, in Polished Brass or Steel Bronze, 3s. Globes from 4d. each. Mantles 6s. 6d. per dozen.

ONLY ADDRESS: **THE NEW INVERTED INCANDESCENT GAS LAMP CO., LD.,**

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R. LAIDLAW & SON,

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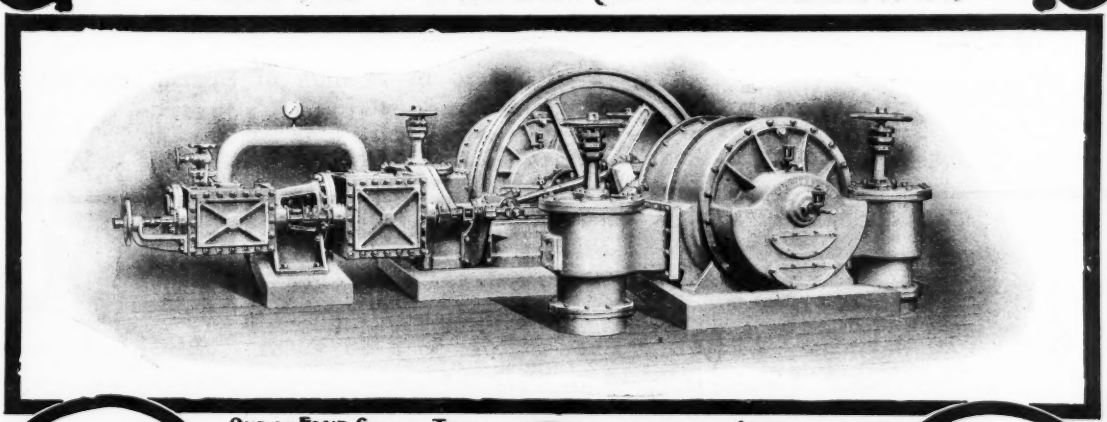

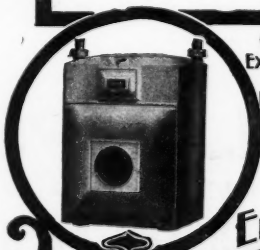

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SIMON SQUARE WORKS, EDINBURGH

CAPACITY OF 1200000 CUB. FT OF GAS PER HOUR AT 80 REVS PER MIN. ERECTED AT NECHELLS GAS WKS. BIRMINGHAM.

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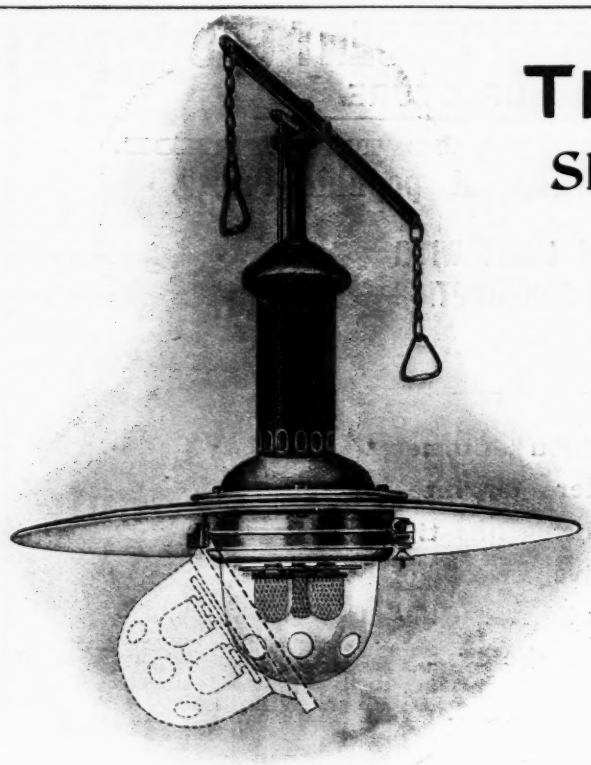
ALLIANCE FOUNDRY & GLASGOW ENGINEERING WORKS,



The "DRURY"

Shadowless Inverted Cluster Lamp.

PATENTED AND REGISTERED.

A very efficient Lamp for all Buildings where a good downward light is wanted.

The special feature of the "**Drury**" Inverted Cluster Lamp is the way in which a cluster of Three Inverted Mantles is suspended from an interior white enamelled plate. The Three Mantles are arranged so close together that they have the appearance of one large brilliant Incandescent Ball, giving a surprising effect of its lighting power.

The Lamp is provided with a small interior Bye-Pass. Only "**Drury**" Mantles should be used to obtain the best effect, as they have a special Registered Holder which ensures the Mantles keeping a central position.

No. 2203. For Indoor use, 49s. 6d. Complete with Mantles, as shown. Extra Mantles, 7s. per dozen.

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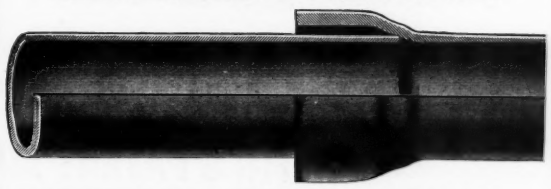

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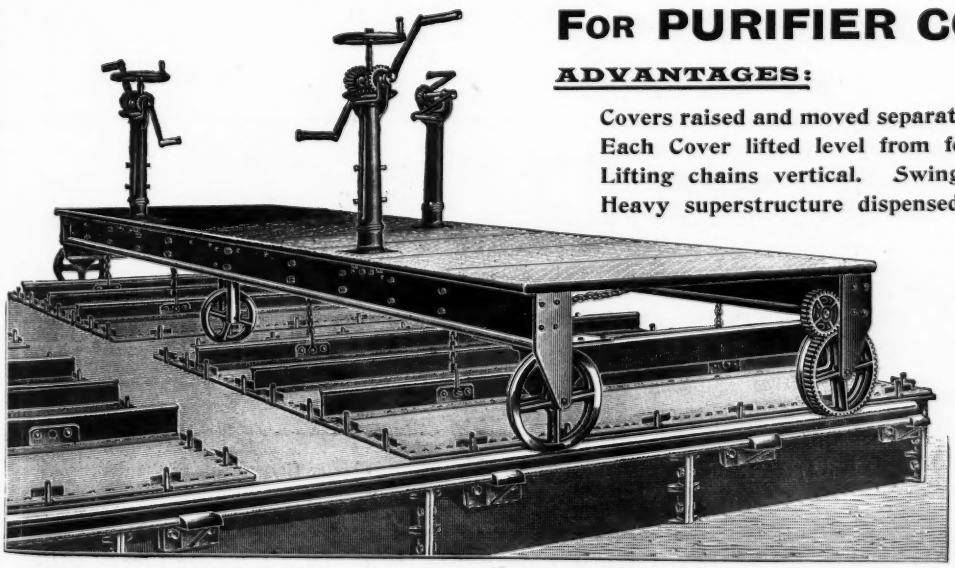

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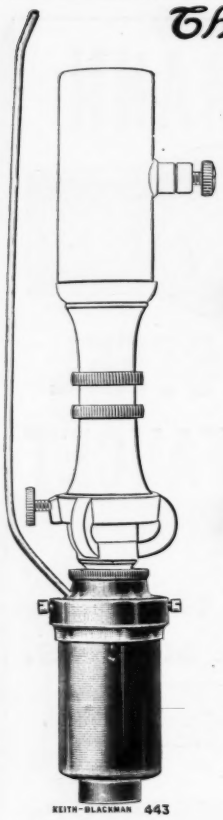

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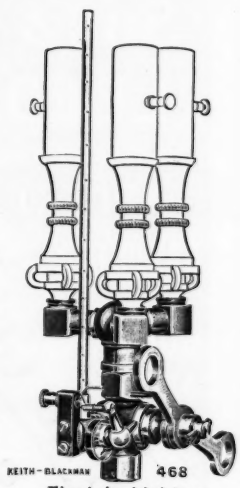

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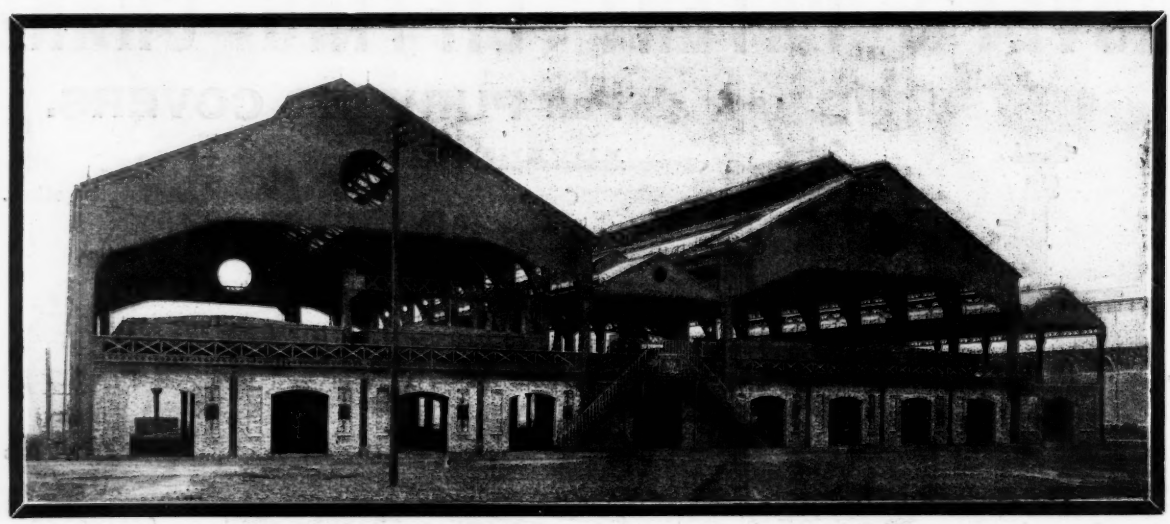

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Printed for WALTER KING by King, Sell, & Olding, Ltd.; and published by him at 11, BOLT COURT FLEET STREET, in the CITY OF LONDON.—Tuesday, Jan. 10, 1905.